for . . .

engineers and contractors controlling the design, specification, installation and maintenance of heating, ventilating and air conditioning.

HEATING AND VENTILATING

The Air Conditioning Monthly

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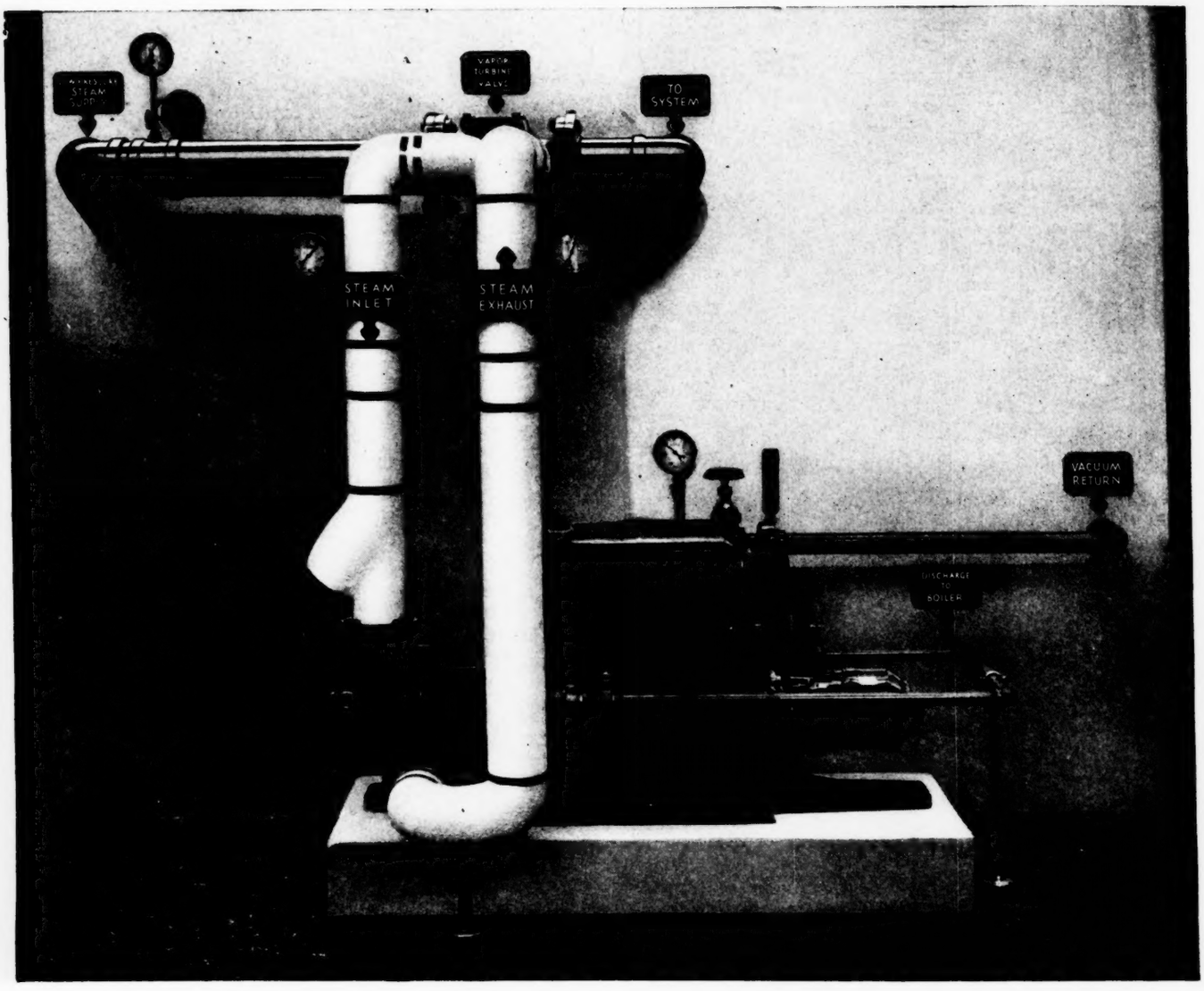
CONTENTS FOR JULY, 1942

VOLUME 39 NUMBER 7

Buick Division of General Motors	25
District Heating Engineers Meet at NDHA Convention	30
Match Box Makes Handy Tape Holder	32
Profits in Air—Ace Carton Corporation	34
National Photo Company	39
Empresa Colombiana de Curtidos	39
Twelve Newspapers	40
Vanadium Corporation of America	41
Tank Ventilating Costs Cut	42
The Fuel Oil Situation in the East	46
Atmospheric Sabotage	47
The Climate in Yuma	49
Winter Heat Gains in Fuel Consumption Estimates	50
Washington News	53
Degree Days for May 1942	57
Liquefied Natural Gas Stored in Tanks at −258F	58
Reference Data 225 and 226	58
The Welding of Piping—III	59
Reviews of Technical Publications	64
News of the Month	66
New Equipment	68
New Catalogs	76
Personals and Personnel	78
With the Manufacturers	79
H & V's Photos	80
Summer Degree Hours for April and May	80

MEMBER
Audit Bureau of Circulation
Associated Business Papers

Interrupted Electric Service will not Stop this Nash Heating Pump



In Hospitals, Greenhouses, Schools, Public Buildings, Theatres, wherever heating systems must not fail, install the Nash Vapor Turbine, for it is independent of electric current failure, and continues to operate as long as there is steam in the system.

This is because the prime motive power of this economical pump is a special steam turbine, controlled by a unique "Vapor Turbine Valve", which automatically bypasses from the heating main a small portion of steam, the exact amount necessary to develop the power needed to remove the condensate and maintain the required vacuum on the system. Even this small amount is passed immediately back to the mains, and goes on to the system with little heat loss. This pump operates on any system, high or low pressure.

The Vapor Turbine is a most economical pump, for the elimination of electric current does away with current cost, the largest single item in the operation of an ordinary return line heating pump. Bulletin on request.

THE NASH ENGINEERING COMPANY

205-A S. WILSON ROAD, SOUTH NORWALK, CONNECTICUT, U. S. A.

Office building, Buick's airplane engine plant. Project designed by Albert Kahn Associated Architects and Engineers, Inc.

BUICK DIVISION

of General Motors builds plant for manufacture of Army plane engines, now in production. Heating by unit heaters, summer ventilation for factory, and air conditioned test cells, described by G. S. Whittaker.

CONSIDERED by military authorities to be top performance, and representative of the speed with which automobile manufacturers have swung into their tremendous war-time jobs, the Buick Division of General Motors is now in full production of airplane engines for the Army Air Corps in a huge plant in Melrose Park, Ill., — a plant in production within 8 months of the blueprint stage.

Beyond a certain point statistics in terms of great magnitude become meaningless. Consequently, the Government's request that factory size and production figures be given no publicity works few hardships in this case. It is sufficient to say that Buick brought to completion one of the largest Defense Plant Corporation projects in the national war production program and readied that project for mass output.

Structurally and in point of plant layout and equipment, the Buick engine plant is one of the most completely modern yet constructed. Designed specifically for aircraft engine manufacture following automotive technique in production line methods, the huge manufacturing department is all under one roof.

Buick's is the first airplane engine plant to be located in the Chicago area, and in this plant the company will employ the largest number of men working under one roof in the Chicago district. The plant will rank seventh in the area in total number employed. Ultra-modern in every respect, with provision for blackout in the event of wartime emergency, the plant is located west of the heart of Chicago's Loop.

As far as Buick is concerned, history is repeating itself. In World War I, less than 25 years ago, Buick rushed to the aid of the country as one of the major builders of the famous Liberty airplane engines. Then, as now, the company erected special factories and installed specialized equipment to take care of wartime needs.

The aircraft plant, itself, is a Kahn industrial unit designed in collaboration with Buick engineers for straight-line production in its most efficient form. The plant is so laid out that it can be quickly enlarged at any time in the future, should the need for expansion arise. In the plant's construction, steel, glass, concrete and brick were dramatically composed into a harmonious whole.

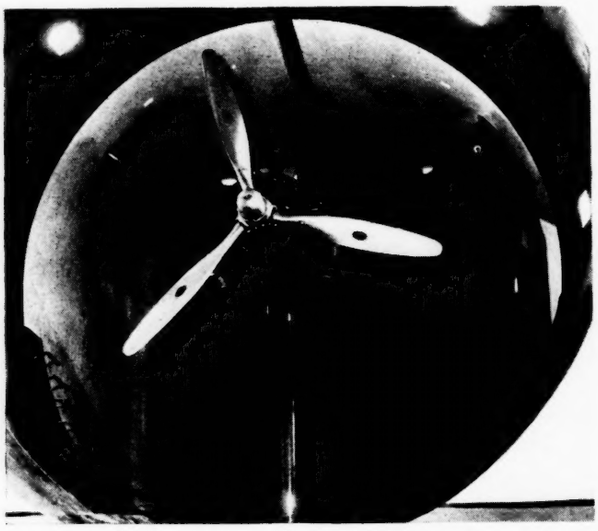
The layout consists of:

A three-story Administration building, with full-size basement;

A one-story manufacturing and assembly building. Stretching across the end of this structure is a two-story section containing factory offices, drafting rooms, engineering laboratories and other such departments. Under this building are cafeterias, lunchrooms, locker rooms and washrooms;

A one-story garage;

A typical view in the Buick airplane engine plant. Note the unit heater.



Propeller test stand where engines are given test runs. This is in addition to production test stands where the engines are hooked up with generators.

View in the preparation room outside the dynamometer test cells which are located behind the doors to the right.

A dynamometer test building, containing many specially-designed airplane engine test cells, each pair separated by a control room, all of them boasting a number of scientific innovations;

A propeller test building, and a personnel and employment building.

A problem in heating the factory portion of this project was in making the decision whether the plant should be heated by overhead unit heaters and ventilated by roof vents with motor-driven fans or whether it should be air conditioned in the summer, with heaters at the doors for winter use. After careful deliberation it was decided that summer temperatures in the Chicago district are not such as to make air conditioning necessary, and that a reasonably comfortable working temperature could be obtained with roof ventilators. After this decision was made it was a simple matter to compute air quantities to insure comfortable summer temperatures as well as winter conditions.

When roof ventilators were selected for ventilation, the problem of choosing a heating method was considered. The selection must be such that it would be both efficient and inexpensive. After some consideration, overhead down-blow unit heaters were selected for the manufacturing area, with overhead blower type units in the truck wells, shipping, and receiving departments, and at all the large doors.

The factory office section, office building, and the personnel building are all heated by direct radiation and hot blast systems, described later.

Steam for the heating systems is generated at 175 lb pressure through three high pressure underfeed-stoker-fired boilers with a capacity of 45,000 lb. of steam per hr each. Auxiliaries, such as some pumps, and the air compressors, are steam-driven, with high pressure steam, and a back pressure of 30 lb. This back pressure steam, which totals about 35,000 lb per hr, is used for heating as well as processes.

In relatively mild weather when there is a light heating load, enough steam is available from the steam turbines in the power house to supply all the heating needs and the process requirements. However, as the whether gets colder and the quantity of steam required increases materially, another steam main is cut in to make up the extra steam required. With this system it is possible to utilize all the available back pressure, 30-lb steam at all times.

Overhead unit heaters selected for the factory heating system are all located above the bottom chord of the trusses and are equipped with diffuser outlets properly to distribute the heated air over the area which the heater is intended to cover.

All the unit heaters are controlled by push-button magnetic starters with 110-volt pilot control which is operated in conjunction with a thermostat. These starters have 3-way selector switches in the cover marked On, Off and Auto; such an arrangement allows the unit heaters to be operated in the summer time.

Calculations for summer conditions proved that comfortable working conditions could be maintained if a lively and efficient movement of air were provided so as to remove the heat generated within the plant. The increase in temperature above the floor due to stratification was estimated at one degree per foot. The heat to be removed from the building is the total of sun effect, motors, occupants, and illumination, less the heat lost through the building construction due to the higher average temperature within. Knowing the quantity of heat to be removed and the temperature of the air in passing through the building, the volume of outside air necessary to maintain a livable condition, was calculated and unit ventilators selected to remove the necessary quantity of air. The advantages of such a design are low cost, elimination of ductwork within the structure, and speed in construction—all vital points at this time.

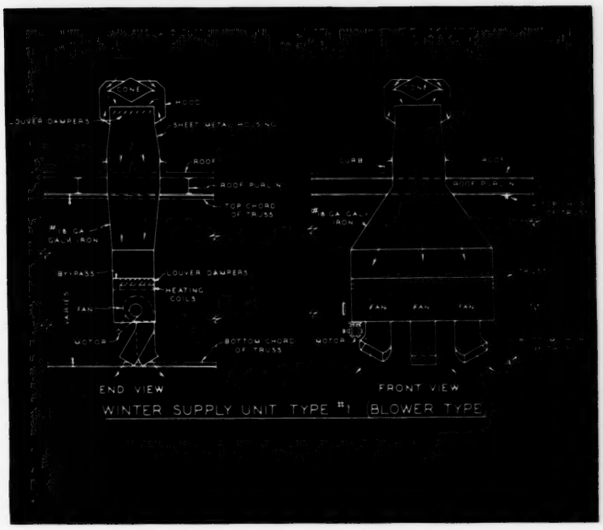
The unit ventilators which are installed in the roof are of three types, namely, summer exhaust, summer supply, and winter supply units. Each of these units has a capacity of 10,000 cfm and is equipped with a push button starter and automatic intake damper which is interconnected with the fan motor, so that whenever the fan motor is turned off the damper motor on the intake damper is de-energized, and the spring return on the damper pulls the damper shut.

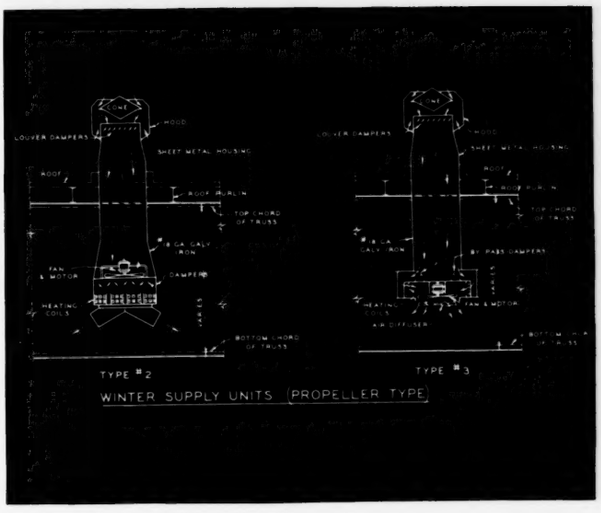
Winter supply units are the same as the summer supply units except that the winter units have a heating coil with face and by-pass dampers operated by a room thermostat. With these, there is a constant supply of fresh air all winter, equivalent to one air change over an area 12 ft high.

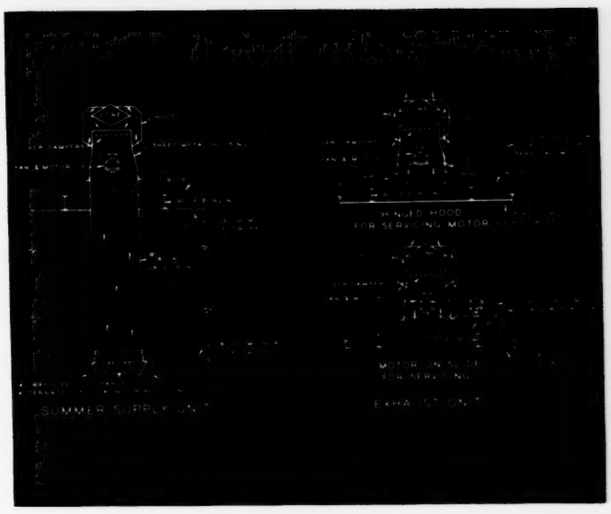
In plating and process departments, where air is exhausted for the purpose of removing gases or dust, special care is taken to replace the same with suitably tempered air which will in no way disturb the conditions in the surrounding area.

In the basement area beneath the factory floor are the locker and lunch rooms and the cafeteria and kitchen with all interconnecting passageways and stairways to the factory floor. These are designed to serve definite sections of the building; a man entering the plant may go direct to his locker somewhere near the location of his work bench. Lunch room and toilet facilities serve him in this same vicinity. When ready to take his position on the plant floor a stairway takes him to a point within a short distance from that position. This basement area, therefore, serves to solve a traffic problem which would otherwise cost millions of man hours per year.

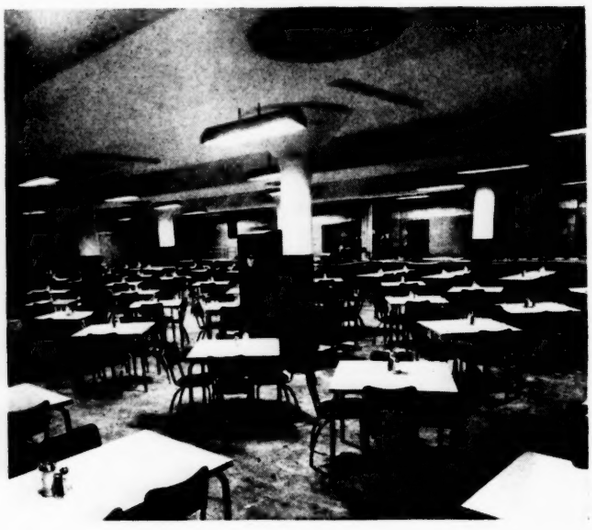
Complying with Chicago ventilation codes, which are designed for healthful conditions, and allowing a safe margin for a possible damaged system, the ventilation in this area may be considered second to none. Yet it is plain and economical. Four equipment rooms supplying, warming, filtering and exhausting air serve all locker rooms, lunch rooms and the cafeteria and kitchen—the air being delivered



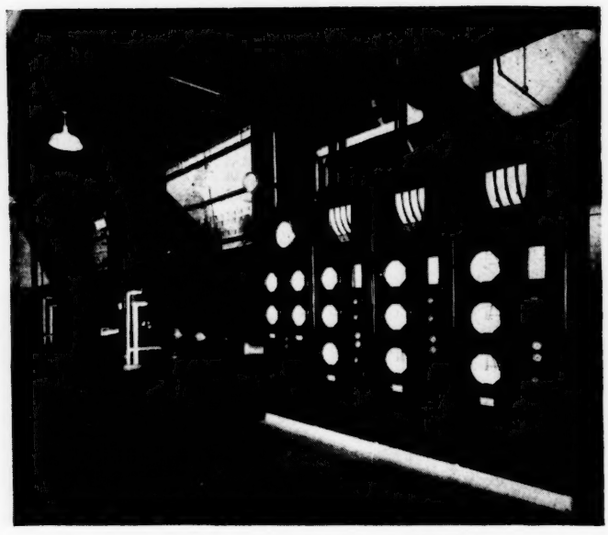




Three of the ventilating type units used in the Buick plant.



This employees' air conditioned cafeteria at the Buick aviation engine plant seats 2000 at one time.



View in the boiler house of the Buick plant showing the stoker-fired boilers and instrument panel.

through main trunk ducts and supplied through wall registers or ceiling outlets.

The basement area is heated by a fan blast system supplied with steam through pressure reducing valves which reduce the pressure to 5 lb. The condensate from the blast coils, as well as all the condensate from the unit heaters, winter supply units, kitchen equipment, and process equipment runs to pump and receiver sets located in the fan rooms, from which the water is discharged back to the main receiver.

The factory offices, two stories in height, consist of general office space, chemistry laboratories, physical test laboratories, dark rooms and photographic rooms, various design rooms and toilets. Each has its own conditions and is treated accordingly.

The first floor of this area is ventilated by individual supply and exhaust units mounted in the factory truss space. The second floor or designing department is served through two fan rooms located at the quarter points of this section of the building. Air is supplied through twin systems comprised of motor operated oil filters, tempering coils for winter use, thence through direct expansion cooling coils wetted by means of an air washer, all of which serves to cool and dehumidify in the summer, humidify in winter and wash the air as well as remove possible factory or garage fumes from it. It then passes over the surface of the reheating coils which may be used in either summer or winter as may be required, and through the fan unit, after which it is zoned, heated or cooled again and distributed among the spaces requiring necessary conditioned air. Exhaust fans are located in these same fan rooms for recirculation or discharge to the atmosphere. Each of the two units serving the factory office space is served by a 100-ton reciprocating refrigerating compressor with water-cooled, shell-and-tube condenser.

Controls include the following:

1. A motor-operated modulating-type fresh-air damper designed to prevent the entering mixed air from falling below 35F in winter and from rising above 85F in summer;
2. A modulating type recirculating damper interconnected with the fresh air damper;
3. Modulating steam control for the tempering coils;
4. Modulating steam control for the reheating coils;
5. A solenoid shut-off valve for control of the direct expansion coils set to close when the return air drops to a predetermined temperature; and
6. Control of the compressor to pump the refrigerant system down after the liquid line solenoid valve has closed and to permit the compressor to operate only when the fan is in operation and the system is on the cooling cycle.

The main office building making up the administrative quarters is similarly treated. Three stories in height, it is properly zoned to supply cooled or warmed air to each individual office space. The air is exhausted through grilled doorways into the corridor where it is returned to the system or exhausted to the atmosphere.

Fan equipment is located in a penthouse on the roof with a 150-ton reciprocating refrigerating compressor in the basement piped to the direct-expansion coils above. A single supply fan, all properly zoned and cared for, serves the entire third floor, while one exhaust fan returns the air to the system or discharges to the atmosphere, as may be desired.

Direct radiation and a hot blast system heat the office building. Factory office section, personnel building, and the office portion in the test cells are similarly heated. The radiators in the office building are all of the convector type in wall-hung cabinets, except in the toilet rooms and stairways where wall-hung cast iron radiators are provided.

A vestibule heater is located in the space above the revolving door. This unit takes air in through

the top of the heater, from which it passes through the heating coil before being discharged down through a grille just above the door. This unit has a two-speed motor which is controlled by a step-type thermostat located where it will be affected by the cold air entering through the revolving door. The motor runs at full speed whenever the temperature is 68F or lower, drops to low speed when the temperature is between 68 and 72F; above 72F the motor is stopped.

Mains are on the basement ceiling with the risers and radiator connectors feeding up to the upper floors and feeding the unit heaters which heat the basement. The building is zoned by a control system consisting of modulating-type motor-operated valves controlled through zone thermostats located in the various large areas of the first floor. Returns from the radiators run to a high-vacuum pump located in the basement machine room, and tied in with the radiator control system. This pump, which has a low head, operates on a vacuum as high as 20 in., and discharges the water to the condensate receiver which serves the blast coils. The factory office and the personnel building also have convector radiators with returns running directly to the pump and receiver units in place of vacuum pumps.

One of the problems confronting our engineers was the special process of ventilating and conditioning the dynamometer test cells. These cells, each 14 ft long by 15 ft wide, present an extraordinary study for students of air conditioning.

Each engine cell is supplied with a 40,000 cfm high speed supply fan under 20 in. static pressure and driven by a 250 hp motor. The fan is located in a roof penthouse directly over the engine cell supplying air directly over the engine in test. Due to the increased temperature it is exhausted at the rate of 60,000 cfm through outlets provided at the floor and ceiling of the cell and by means of a power fan located in the aforementioned fan house and driven by a special air cooled motor—the motor being supplied by air from an auxiliary fan drawing air from that already used to cool the control room.

Conditioned air is supplied to each dynamometer test cell carburetor in the following manner. Directly below the dynamometer cells is a completely enclosed space known as the carburetor air chamber. At one end is the conditioning unit designed to supply fresh air to the chamber at the rate of 25,000 cfm and to maintain a constant condition of 60F within the chamber or 70F after passing through the carburetor fan.

Within the chamber are located smaller individual high speed fans operating under 20 in. static pressure and driven by a direct-connected motor delivering air through a duct to each carburetor as required when the cell is in operation. These fans are operated from the control room.

Also interconnected with the main supply unit is a secondary fan taken off the discharge side of the main unit and used to provide tempered or controlled air to each control room in order to maintain conditions suitable for the proper calibration of control instruments. This conditioned air may also be drawn into the test cell proper during a period of maintenance through an additional auxiliary disc fan in the wall between the cell and control room.

Water used for condensing purposes for 650 tons of refrigeration on this job is supplied through a 5000 gpm cooling tower of the forced-draft type equipped with adjustable-pitch multiblade fans directly connected to gear reducers with flexible couplings between motor and reducer.

An aggregate number of about 550 fans serve the buildings located on this acreage.

Test cells are heated by unit heaters but the office section for this general area is heated by wall-hung convectors, the condensate from which runs to the various pump and receiver units. There are also steam and return connections serving the various fan coils in these areas and also connections to coils in the oil tanks which serve the engines being tested.

Partial List of Contractors and Sub-Contractors

Architects and Engineers	**Albert Kahn Associated Architects and Engineers, Inc.**	**Overhead unit heaters**	**The Trane Company**
		Unit ventilators	**DeBothezat Ventilating Equipment Div. American Machine and Metals**
General contractor	**Thorgersen & Erickson Co.**		
Heating contractor	**S. J. Reynolds Company**	**Refrigerating compressors**	**York Ice Machinery Corp.**
Plumbing contractor	**M. J. Corboy Company**	**Zone control system**	**Illinois Engineering Co.**
Ventilating and air conditioning contractor	**Economy Plumbing & Heating Company**	**Hot blast coils**	**McQuay, Inc.**
		Air conditioning controls	**Johnson Service Co.**
Boiler house piping	**S. J. Reynolds Company**	**Hot water heaters**	**The Patterson-Kelley Company, Inc.**
Sheet metal duct work	**The Zack Company**		
Induced Draft Fans	**Buffalo Forge Company**	**Temperature control valves**	**Powers Regulator Company**
Coal Handling and Weighing Equipment	**Fairfield Engineering Company**	**Boiler house fans**	**Bishop & Babcock**
		Cooling towers	**Lillie Hoffman**
Boiler Control and Metering	**Republic Flow Meters Company**	**Convectors**	**The Trane Company**
Fly Ash & Dust Collectors	**Buell Engineering Co.**	**Thermostats**	**Minneapolis-Honeywell Regulator Company**
Boiler Feed Pumps	**Worthington Pump & Machinery Corp.**	**Vacuum pumps**	**Nash Engineering Company**
Boilers	**Babcock & Wilcox**	**Condensation pumps and receivers**	**Chicago Pump Company**
Stokers	**Detroit Stoker Company**		

DISTRICT HEATING ENGINEERS MEET

THE 33rd annual meeting of the National District Heating Association was held at The Dayton Biltmore Hotel, Dayton, Ohio, June 11-12. More than a hundred members and guests attended. Hotel rooms being scarce due to the war activities in the city, the Van Cleve and Miami Hotels kindly assisted in housing the delegates. The central theme of the meeting was how to overcome problems created by the war.

Preceding and following the close of the general sessions, meetings of the executive committee with the chairmen of committees were held to complete business of the old year and organize for the new.

For the first time in NDHA history the annual meeting, which has usually extended for four days, was compressed into two, to conserve time. A new feature was the replacing of all but the opening and closing technical sessions by group conferences, at which such subjects connected with the war as protection, substitutes, and priorities were thoroughly discussed.

At the opening meeting, after a minute of silence out of respect for members deceased in the past year, President Leonard S. Phillips, New York Steam Corporation, introduced A. W. Isenhart, vice-president of the Dayton Power and Light Company, who welcomed the members and guests to Dayton. Response was made by John F. Malone, Consolidated Gas Electric Light and Power Company of Baltimore.

In his annual address which followed, President Phillips commented on how the NDHA had swung quickly from a complete peace time program adopted in the fall to one adapted to the needs of the membership in supplying district heating service during an all-out war effort; the first obligation of all being to the Government and the attaining of Victory.

The first group conference considered problems of distribution, insurance and steam generation. Extensions of service of not more than 250 feet in length and requiring material of value not to exceed $1500 are permitted without the approval of WPB; otherwise this permission must be secured, according to Chester F. Ogden, assistant purchasing agent of The Detroit Edison Company, who explained the priority situation and procedure.

In giving the manufacturer's viewpoint on this subject, John V. Redfield, Central Station Steam Company, urged that where a customer has been sold and it is known what equipment will be needed, the orders should be placed without delay. He also urged that no more replacement parts be bought than needed in order that all might have their requirements satisfied.

James E. Harris, Philadelphia Electric Company, speaking on the insurance situation, told of a new policy form and rate schedule to insure property owners through the War Damage Corporation, from loss or damage sustained by acts of war. On heating systems the tentative rate varies from 18 to 30 cents per $100 of insurance, depending on the percentage of concurrent insurance carried.

Among the steps mentioned as being taken to protect plants and property were the wearing of suitable identification badges by all employees and visitors; requiring of passes, signed by proper executives, from all visitors; limiting of visitors to those on company business; protection of openings through which entrance might be gained, and limiting of points of entrance to one with suitable guards.

Other suggestions were that seals be placed on receptacles so that tampering could readily be detected; that equipment be provided for handling incendiary bombs and other emergencies; and that arrangements be completed for transportation, communication and warning signals during emergencies.

The second group conference considered problems of sales, rates and commercial relations. President Leonard S. Phillips, substituting for Robert D. Martin, New York Steam Corporation, chairman of the sales development committee, explained how the oil shortage on the East Coast has resulted in a swing to district steam where this service is available, what steps are being taken to provide service and conserve oil, and what is done in the securing of necessary equipment which is being used in minimum quantities, many of the usual accessories being omitted for the duration.

Rates and regulations were reported upon by J. Earl Seiter, Consolidated Gas Electric Light and Power Company of Baltimore, chairman of that committee. He intimated that where adjustment clauses were not contained in former schedules covering changes in the cost of fuel and labor and in taxes, in a majority of cases such clauses are being added or contemplated. The report was for the calendar year 1941, and although the war did not begin until December, the cost of such items was on the increase.

The completion of the printing by the National Association of Building Owners and Managers of the 1942 issue of the pamphlet *Principles of Economical Heating* was mentioned by Chairman George Tuttle, The Detroit Edison Company, chairman of the NDHA committee that collaborated on its preparation, in opening the discussion on commercial relations.

R. M. McQuitty presented a paper on the steam requirements of equipment in hospitals, laundries, cleaning establishments, kitchens and clothing factories. The data included was obtained by actual meter measurements on the premises of the customers of six steam companies and was supplemented

AT NDHA CONVENTION

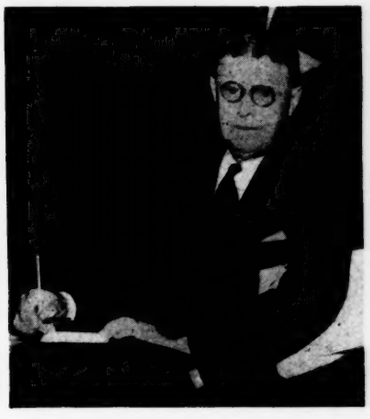
Delegation from the Detroit Edison Company at the National District Heating Association 33rd Annual Meeting, Dayton, Ohio.

William A. Herr, Philadelphia Electric Company, the newly elected president of the National District Heating Association.

(Left) Joseph M. Baunes, membership chairman, Philadelphia Electric Company. (Center) Glenn Shaw of the Dayton Power & Light Company. (Right) W. W. Stevenson of the Allegheny County Steam Heating Company.

(Left) C. N. Maxfield of the Yarnall-Waring Company, Detroit, Mich. (Center) H. L. Roe of the Dayton Power & Light Company. (Right) W. A. Schulmeister of the American District Steam Company, North Tonawanda, N. Y.

(Left) J. B. Redfield, Central Station Steam Company. (Right) Warren W. Parks, Cincinnati.



H. C. Kimbrough, American District Steam Company, Chicago.

John F. Collins, Jr., secretary-treasurer of NDHA.

by additional figures previously published. Attention was called to the fact that there are three general classes of heating equipment—those with dry heating surfaces, those with submerged surfaces and those with jets. He brought out that requirements vary with the method of trapping, method of operation, method of reporting demand and method of metering.

A paper on the sizing of economizers was given by A. F. Metzger, Allegheny County Steam Heating Company, Pittsburgh. This brought out considerable discussion and it was indicated that additional research should be made on this important subject.

The estimating of and billing for steam used by open jet humidifiers was discussed by Henry L. Warhanek, Wisconsin Electric Power Company, who was interested in a better method of metering this use.

Research and chemistry problems were considered at the third conference, and a report on weather statistics was heard. The first item in the report of this committee, of which George K. Saurwein, Harvard University, is chairman, was a paper on Air Cell Concrete, by H. W. Frederick, of Cornell University. Mr. Frederick recommended the use of this material for insulating in place of magnesia, of which there is an impending shortage.

The second item was a paper by W. F. Friend and R. E. Hansen, Ebasco Services, Inc., New York, on the subject of Measuring the Volume of Buildings for the purpose of comparing and estimating steam consumption for space heating. A lively discussion followed efforts to arrive at a common basis of computation, and it was agreed that additional study is desirable.

In summarizing the work of the chemistry committee, Leo F. Collins, The Detroit Edison Company, described the activities of the ASHVE and other groups on the corrosion problem. Substitutes for boiler water treating chemicals were discussed by Dr. E. W. Guernsey, Consolidated Gas Electric Light and Power Company of Baltimore.

Progress being made on the formation of a joint committee on weather statistics was reported by S. S. Sanford, who said that the American Gas Association had named Raymond Little, Pittsburgh; the ASHVE, Professor Clark M. Humphreys; Oil Burner Institute, Frank H. Dewey; the U. S. Weather Bureau, Dr. E. Dillon Smith, Washington; and NDHA its secretary, Mr. Collins.

The summary of the report of the operating statistics committee, made by T. P. Brown, Jr., vice-chairman, showed that for 1941 in most areas where steam is served, much warmer weather than usual was experienced, and there was a general decrease in sales volume and revenue but an increase in average revenue and connected load. Fuel cost increased greatly and the hourly labor rate increased considerably.

The Annual report of the secretary-treasurer, John F. Collins, Jr., of Pittsburgh, reflected the fine financial condition of the Association, which recently purchased a U. S. War Bond with reserve funds.

Chairman Joseph M. Barnes, Philadelphia Electric Company, reporting for the membership committee, indicated that no material change has taken place in the past year in the membership now numbering 428.

At the closing meeting the Association unanimously adopted the report of the Nominating Committee, naming William A. Herr, Philadelphia Electric Company, President for the year 1942-1943; J. J. Schenk, Rochester Gas and Electric Corporation, Rochester, N. Y., First Vice-President; John M. Arthur, Jr., Kansas City Power and Light Company, Kansas City, Mo., Second Vice-President; S. S. Sanford, The Detroit Edison Company, Third Vice-President; and Leonard S. Phillips, New York Steam Corporation; John F. Malone, Consolidated Gas Electric Light and Power Company of Baltimore; and R. M. McQuitty, Union Electric Company of Missouri, St. Louis, all members of the Executive Committee. John F. Collins, Jr., continues as Secretary-Treasurer.

Match Box Makes Handy Tape Holder

The eye end of a tape line is not an easy thing to hold accurately when gloves or mittens are being worn. To overcome this difficulty, take a penny wooden match box, remove the tray, and cut down the center and along the bottom of one side of the tray, letting the cut portion hinge on the end, as shown. Hook the eye of the line over this and put the tray back in the casing, or slide-box. This holds the eye securely and firmly at the extreme corner of the box, with the end of the tape approximately flush with the edge of the box. The box then affords an excellent grip or holder for the fingers, no matter how heavily they may be protected with the usual hand covering. The tape end can be held squarely over any mark on any surface, against corners and about any other place necessary.

PROFITS IN AIR

This new Republic Steel furnace, lighted May 28, is air conditioned to avoid blowing 18 tons of water into the furnace daily. It is located "somewhere in the Southeast."

HOW INDUSTRIAL PLANTS PROMOTE PROCESSES BY CONTROL OF AIR CONDITIONS

METALLURGICAL

FOODSTUFFS

ORDNANCE

CHEMICALS

AIRPLANES

FOUNDRIES

TOBACCO

TEXTILE

BAKERIES

ELECTRICAL

FILMS

INSTRUMENTS

GLASS

MACHINE SHOPS

PHARMACEUTICAL

PLASTICS

PAPER

RUBBER

PRINTING

PROFITS IN AIR

ACE CARTON CORPORATION

builds windowless plant with year-round air conditioning system with 21 industrial humidifiers of unit type. Advantages of system are low cost, flexibility, and control by partial saturation.

By H. BROWN REINHARDT, JR.
Sales Engineer, Carrier Corp., Chicago

WITH a shop space 400 by 200 ft, without windows, the modern carton manufacturing plant of the Ace Carton Corporation, Chicago, is equipped with a year-round system of air conditioning for relative humidity control. The unusual feature of the system lies in the apparatus employed —21 industrial humidifiers, each performing all the functions of a spray-type central station humidifier, but accomplishing their purpose without the use of duct work. Although the psychrometry of this type of system is the same as that applied for many years to most of the early air conditioning installations, it might not be out of order to review the principle of the humidifying job, and the results to be expected from it. In recent years, the dehumidifying job has become so common that many people are inclined to think along those lines and forget the type of job which gave the air conditioning industry its start.

Manufacturing Process

The Ace Carton Corporation, formed in 1928, has enjoyed a healthy growth. As a result, it found itself in 1941 with a small shop crowded with work, and two separated warehouses, one for storage of raw material and the other for finished goods. The acquisition of a new building to include warehouse space as well as an expanded shop was, therefore, a logical step.

To understand thoroughly the requirements to be met by the air conditioning system, first consider the various operations involved in the manufacture of cardboard cartons. The raw material, consisting of sheets of light cardboard about 4 x 6 ft, is received on skids piled 5 to 6 ft high, forming a solid block of paper. Its moisture content when received is seldom exactly right and must be corrected by storing in an air conditioned space.

The first operation on the cardboard is the printing in multiple repeat forms, usually in several colors, of whatever is to appear on the finished product. This requires the handling of the cardboard through a printing press several times.

The cardboard next goes to the cutting and scoring press where it is cut around the outline of the cartons and also scored for folding. When the press

Interior of Ace Carton plant showing humidifying units suspended along each side of center bay.

makes its cut, the waste does not fall away but must be removed by hand. To accomplish this, a pile of sheets several inches thick is accumulated as they come off the cutting press, and the waste knocked away manually with hammers.

At this point the separated cartons are ready for folding and gluing. Both of these operations are performed on a single automatic machine which feeds itself from a stack of blanks, applies the glue, and makes a fold at one edge to bring the glued flap into proper position. When it leaves the machine, the product is finished and goes either to finished storage or directly to the shipping room.

Need for Air Conditioning

Even with this brief outline of the operations performed, some of the reasons for installing an air conditioning system are obvious. Others may be more obscure. Here are the various points that were given consideration:

1. The moisture regain of the cardboard must be high enough to prevent cracking where it is scored, but at the same time low enough to allow rapid drying of the ink;

2. Expansion and contraction of the board resulting from a variation in relative humidity should be eliminated. This is important not only because of the necessity for proper register in the printing of several colors, just as in any color printing work, but also to obtain proper register in the cutting press;

3. Relative humidity and air motion should be controlled in the gluing department to facilitate the drying of the glue;

4. A certain amount of dust is created which should be removed from the air. Most of the dust results from the cutting operation although some comes from the edges of the sheets of cardboard as they are received. The dust is harmful in two ways —first, from a health standpoint, and second, because it mars the printing work; and

5. An additional consideration is the comfort of the employees.

The next step was to determine what is required in the way of air conditions to assure the various results. Taking them in the same order as given above, the following conclusions may be drawn:

1. Data available in the carton manufacturing industry indicate that 45% relative humidity is a safe low limit to prevent cracking in the scoring operation. Likewise, humidities as high as 60% are satisfactory as far as ink drying is concerned;

2. To prevent expansion and contraction of the board, the relative humidity must be maintained constant from day to day. No definite relative humidity is required to meet this condition, as long as it is held constant over long periods, and is the same in all parts of the various departments;

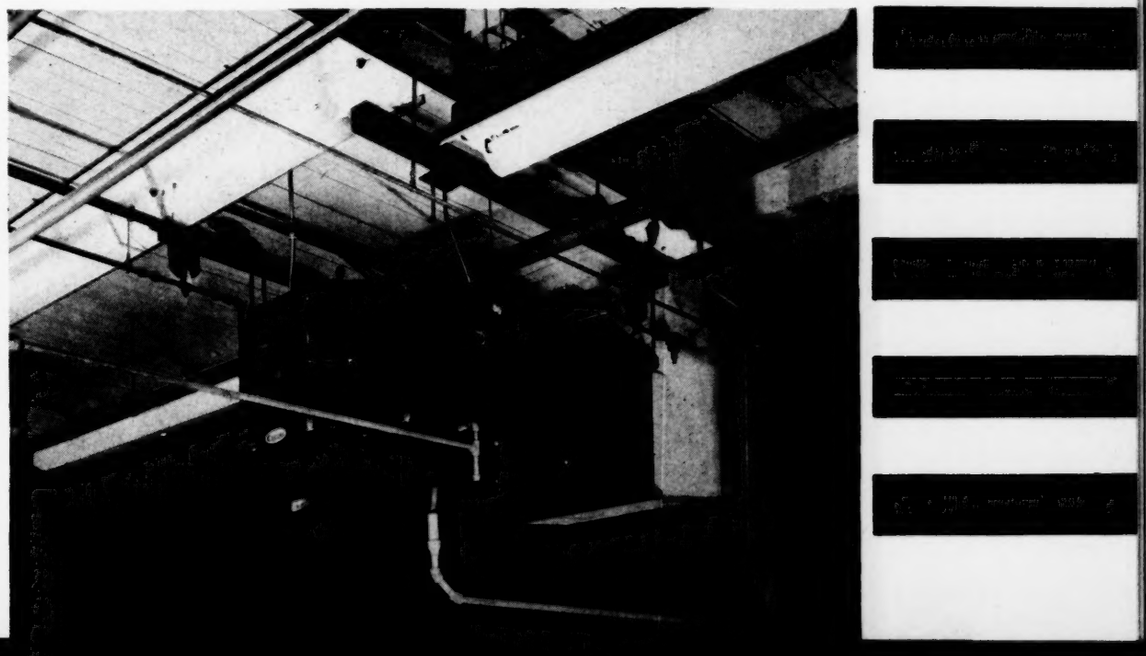
3. From previous experience on similar jobs, it was determined that proper drying of the glue could be expected with a relative humidity of 60% or lower, in combination with a reasonable circulation of air;

4. Reduction of the amount of dust in the air could be accomplished by means of an air washer, filters, exhaust hoods over the stripping tables, stripping tables with dust collecting filters built in, or by partitioning off the cutting room and exhausting a large quantity of air; and

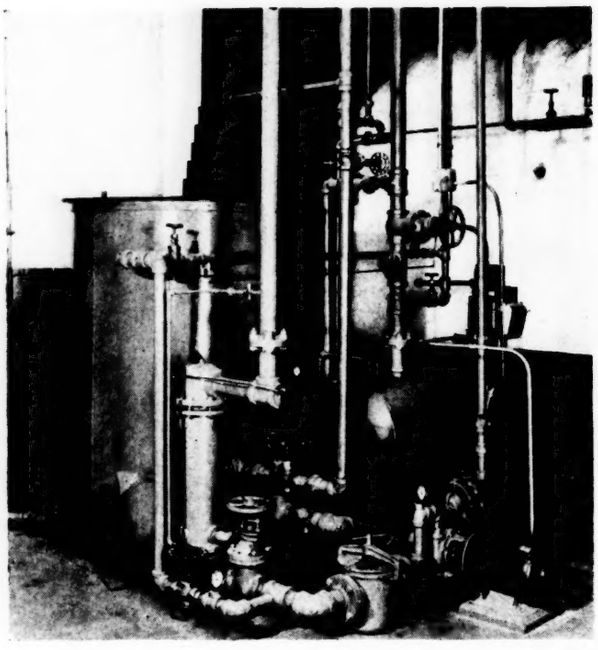
5. In considering comfortable working conditions, it was recognized that to do a good job would require dehumidification in the summer to control not only the relative humidity but dry bulb temperature as well.

This analysis indicates in a general way the conditions which the air conditioning system should maintain to do the best possible job. The most important requirement is to maintain a constant relative humidity at all times, somewhere between 45% and 60%. Next in importance is some means of eliminating dust, using one of the cleaning methods mentioned. Dry bulb temperatures in the summer should be maintained at about 15F below outside dry bulb, and at 70 to 75F in the winter. As a further refinement, it would be desirable but not necessary to keep the dry bulb temperature in the cutting department a few degrees cooler than in the other departments because of the strenuous work performed there.

Although a system accomplishing all the above re-



One of the 21 humidifying units at the Ace Carton plant, showing outside air connection, Powers dew point thermostat, condensate return line, water drain line, and air outlets.



Central water handling apparatus at Ace Carton plant serving the 21 Carrier humidifying units.

sults would be ideal, it is readily seen that the only purpose of dehumidification is in controlling dry bulb temperature for the comfort of the employees. An estimate of the cost of either refrigeration or a well to provide sufficient cold water led to a decision to use a humidifying system, which would be entirely satisfactory as far as the product was concerned, at a considerable saving in first cost and operating cost. In reaching this decision it was recognized that there would be some periods during the summer when uncomfortable conditions would occur, but by proper design and control of the system, it was felt that these periods could be kept to a minimum.

Principle of Humidification

The principles of a humidifying system are reviewed briefly. In the summer, there are certain sources of heat that affect the temperature within the plant. Among these are lights, electric motors, people and solar heat gain on walls, roof and glass. With windows and doors closed as they must be if any control of conditions is to be attempted, the heat gain would not only build the temperature up to an exceedingly uncomfortable point, but in so doing would cause the relative humidity to drop, since the latent heat gain is usually small in comparison to sensible heat gain. To absorb the sensible heat load, air is introduced to the room with as low a moisture content and as low a temperature as can be obtained in the proper volume, so that when the air is heated by absorbing the room load, the resulting condition gives the desired relative humidity. By referring to a psychrometric chart, it is found that in the range of room temperature used in practice, saturated air heated through a given temperature range results in practically the same relative humidity regardless of the saturation temperature. For example, to get a relative humidity of 50%, the air must be heated 22F above saturation; to get 60%, it must rise 16F. Therefore, after the heat gain to the room is determined, the minimum supply air quantity is determined by the selection of the relative humidity to be maintained—the lower the relative humidity, the lower the air quantity.

Another effect of the selection of the relative humidity is the resulting dry bulb temperature. Obviously with a room humidity of 50%, which means a 22F temperature rise above saturation, the resulting dry bulb temperature will be 6F higher than for a 60% relative humidity and a 16F temperature rise. For this installation, it was decided to use a 50% relative humidity in the winter, but to reset the controls to carry 60% in the summer, to keep the dry bulb temperature from getting too high.

Air Conditioning Load

With the design conditions established, the next step was to determine the summer heat load to be absorbed. Upon this figure hinges the capacity of the apparatus required. As happens only too infrequently for overall economy, the detail construction of the building had not yet been decided, so it was possible to keep the load down considerably below what it would have been had the building already been built. The load was made up of the following items: Solar heat gain through roof and glass; heat from motors on presses and other machinery; gas burners on printing presses for quick drying of ink; heat from lights; and heat from people.

The only one of these sources of heat that could be materially reduced by altering the building construction plans was the solar heat gain, the others being more or less fixed by requirements of the manufacturing operations. An analysis of the roof load showed that the cost of one inch of insulation on the two inch wood roof contemplated was more than offset by a saving in first cost of equipment.

Careful consideration was given to various methods of reducing the heat gain through the glass. The original building design called for continuous sash in the walls as well as four sets of monitor sash, each running the full length of the building. The saving in cost of air conditioning was evaluated against the cost of inside shades, outside venetian blinds, special heat resistant glass, and glass blocks. In each case, although the air conditioning cost was somewhat reduced, the cost of the blinds or special glass was a considerable item. The solution came when the owner investigated fluorescent lighting, and found he could carry on his color printing satisfactorily without natural light. This led to eliminating all glass from the factory space, which reduced both the cost of the air conditioning and the building. It also solved the problem of condensation on the glass

with the high humidity desired for winter operation. After these decisions were reached, the evalution of the load was an easy calculation.

Types of Equipment Considered

With the design conditions and the load determined, the next step was to decide upon the type of equipment best suited to the job. Three general types were considered, namely:

1. Central station systems, consisting of four large capacity spray type humidifiers, each with its outside air intake, preheaters, reheaters, controls, and each with air distributed to the conditioned spaces through a rather extensive duct system;
2. Unit humidifiers, performing the same functions as a central station apparatus, but located throughout the conditioned space distributing air without duct work; and
3. Spray heads or some other method of evaporating moisture within the conditioned space.

Spray Heads

At first thought, the spray heads appear to be considerably less expensive than the other two systems. Such is not the case, however. To the cost of the spray heads and piping to them must be added the cost of a heating system for winter and a complete ventilating system with duct distribution for summer.

Central Station System

The history of the central station system is reviewed briefly. It had its origin more than twenty years ago in the textile mill—mainly cotton and silk. In those days both the product of the mill and the manufacturing processes were well standardized and stable. The same product was turned out in the same way year after year. Then came rayon and with it the development in the silk industry of a wide variety of twists, weaves, and patterns. Because the cotton mill continued its standardized practices, the competition almost put it out of business. The salvation of the cotton industry came when it turned to variety in its products. This meant rearranging the textile process, adding new machinery, and frequent shifts to meet the demands of the market.

Until the new practice was instituted in cotton mills, the central station system was practically perfect. As long as nothing was done to change the load on the air conditioning system, such as relocating machinery or increasing the motor load by adding new equipment, there was no need for flexibility. A duct system, properly designed at the time of installation, continued to provide the proper quantity of air from each outlet at the correct conditions year after year. When the era of frequent changes arrived, the inflexibility of the central station system became a liability. Under the new conditions, the ideal air conditioning system became one which retained as many of the advantages of a central station system as possible (especially positive air circulation in ample volume), and in addition was flexible enough to meet the requirements of a more or less constantly changing manufacturing process.

Because of a desire for flexibility to take care of future changes as well as a considerable saving in cost, which eliminated consideration of the central system, and because of the greater overall cost of heating and air conditioning if spray heads were used, Ace Carton Corporation selected the third method—use of humidifying units.

Unit Humidifier

Each of the twenty-one humidifying units used is in reality a small central station system. Its essential parts are outside air and return air dampers, humidifying packs, reheater coil, fan and motor, and air distributing outlets. As shown in Fig. 1, the dampers are in the shape of quadrants. They are designed for a very small percentage of leakage when set to take all air from the outside or from the room.

The humidifying packs are somewhat similar to filters in appearance but are made of a hygroscopic material, rather loosely packed to keep down the resistance to air flow. The reheater coil is made up of the conventional finned tubing. A single disc fan is used to supply air through the two outlets. These, as the diagram shows, are set at an angle, and, since they are equipped with vertical louvers, it is possible to discharge a part of the air at right angles to the long dimension of the unit. They are also equipped with horizontal louvers to obtain vertical adjustment of the air stream. All parts are factory assembled into a compact unit suitable for suspension in the conditioned space. Water from an external source is supplied to a distributing pan located above the packs, provided with a row of small holes directly over each pack. Excess water finds its way to a drip pan beneath the packs and is drained off. Because of the hygroscopic characteristic of the material in the packs, the constant supply of water over them, and the tortuous air passages through them, a high humidifying efficiency is obtained.

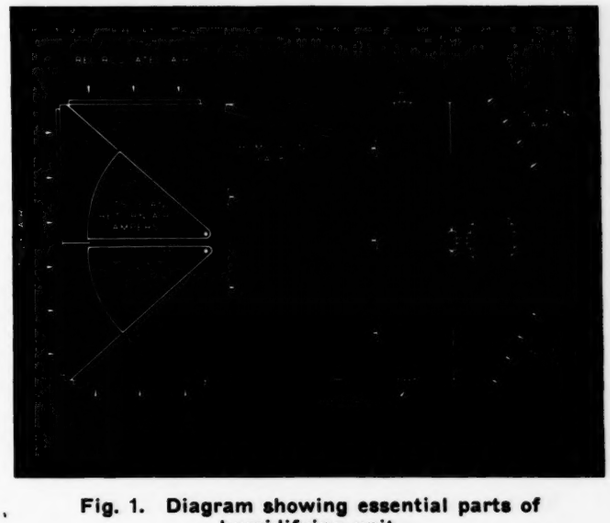


Fig. 1. Diagram showing essential parts of humidifying unit.

Connections required to each unit consist of electrical service to the motor, steam and return lines to the reheater coil, water supply and drain connections and an outside air intake. Since the water must be heated for winter operation, water for all units is supplied from and drained back to a central point. The excess water is returned to an open tank equipped with make up line and float valve. A pump takes water from the tank, pumps it through an indirect hot water heater and into the lines supplying the pans on each unit. Because of the small quantity of water necessary to keep the humidifier packs wet, the total quantity circulated need be only a very small percentage of that required by an air washer of the same humidifying capacity. Accordingly the water piping, pump, heater and tank are small and add little to the cost of the complete installation.

Controls

The full benefit of any installation of air conditioning is not obtained without adequate automatic controls. This is especially true in the case of an industrial application of this kind. Accordingly, the unitary job is equipped with a control system which eliminates practically all manual operations. Aside from starting the fans and water circulating pump, the only manual operation required is the occasional resetting of the thermostat controlling the temperature of the water supply. The water temperature is not critical but must be kept high enough to give sufficient humidification, as the outside temperature drops in the winter.

Since the relative humidity is the important factor, the master control is a room hygrostat. Included with it on each control panel is a room thermostat, together with pressure gauges and relays. Each panel controls a group of units, all serving one general area with a typical heat load throughout. Each unit is equipped with automatic valves on the water and steam supply lines, a damper motor to operate outside and return air dampers and a dew point controller. The hygrostat maintains control of relative humidity at all times. In the summer, the thermostat is inoperative, the room temperature varying with the outside wet bulb temperature. In the winter, the thermostat operates the steam valve on the reheater coil to maintain the predetermined room temperature. By an ingenious combination of hygrostat, thermostat and dew point controller, the summer and winter change-over switch, which has heretofore been required, is entirely eliminated.

Control by Partial Saturation

As has been pointed out already, dehumidification, to maintain a lower summer temperature, would have been a desirable feature but was sacrificed because of its cost. As compared with the central station spray type humidifier, however, these humidifying units have the advantage of maintaining room temperatures in the summer a few degrees

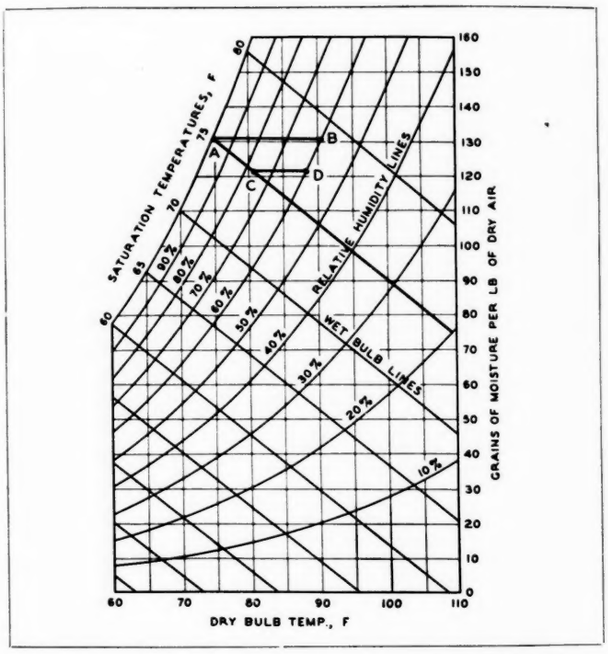


Fig. 2. Skeleton psychrometric chart showing air conditioning process in Ace Carton plant.

lower a great percentage of the time. To explain why this is possible, a typical example may be used. Assume that a 60% relative humidity is to be maintained in a building having a maximum sensible heat gain from motors, sun effect and other sources of 1,760,000 Btu per hour, with an outside wet bulb of 75F. For simplicity, the internal latent heat load, which would be small in any case, will be neglected. It will be assumed that both the central station air washer and the unit humidifying packs will saturate to 100%.

Outside air enters the apparatus at 75F wet bulb and becomes saturated at 75F (point A on the skeleton psychrometric chart, Fig. 2). When this air is blown into the conditioned space it must absorb 1,760,000 Btu per hour, and must then have a relative humidity of 60% as represented by point B on the chart. To reach this point it must pick up 16F in temperature, which means that 100,000 cfm is required. The apparatus would therefore be designed to provide 100,000 cfm and under maximum load conditions, the room temperature would be 91F.

Since this maximum load seldom occurs, consider what happens when the sensible heat load is 50% or 880,000 Btu per hour. With the air washer, there are two methods of control in general use. One is to pass only 50% of the air through the sprays and recirculate the balance. The 50,000 cfm of conditioned air will absorb the 880,000 Btu per hour with a temperature rise of 16F (from point A to point B on the chart) giving a room temperature again of 91F. The other method is to pass all the air through the sprays but to add sensible heat in the reheater, amounting to 880,000 Btu per hour, which, when added to the room heat, again gives a room condition represented by point B.

ACE CARTON PLANT
Designed by
John Cromelin, Architect
Clearing Industrial District, Inc.

The humidifier units used on this job lend themselves to a different method of control to compensate for light loads. All air is passed through the humidifying packs, but by reducing the flow of water over the packs, the air is only partially saturated, leaving the unit at a dew point of 73F (point C on chart). When the full 100,000 cfm of air absorbs the room sensible heat of 880,000 Btu per hour, its dry bulb temperature is raised from 80.5F to 88.5F, resulting in 60% relative humidity. (Point D on chart.)

Although the preceding figures are all based on a maximum outside wet bulb of 75F, this method of partial saturation control results in a corresponding reduction in room temperature regardless of the outside conditions, as long as the actual internal heat load is less than the maximum on which the design of the system is based.

Advantages of Unitary System

Use of humidifying units instead of a central station system has given the Ace Carton Corporation several direct benefits. They may be summarized as follows: First, the lower first cost. The cost of an air conditioning system always has been and always will be an important factor in the selection of the type of system for any application. Second, and also of prime importance, is the matter of flexibility. In these times it is necessary in almost any line of manufacturing to be prepared to relocate machinery or add new machinery to meet demands for new products. Whereas, a central station job would not adapt itself to an extensive revision or increase in the load except at considerable expense, it is a simple matter to install additional units to meet an increase in load in whatever part of the plant it might occur. A third advantage lies in the control by partial saturation, as has been discussed in detail above.

If Uncle Sam needs to call upon the carton industry with a request for its productive capacity for use in the war, he will find the Ace Carton Corporation well prepared with a modern plant and a modern air conditioning system.

National Photo Company

dehumidifies film drying room, cuts drying time sharply

An increase of 600% in the speed with which film is dried in a commercial photo finishing laboratory has been achieved through installation of a silica gel dehydration system.

This is the report of the National Photo Company, St. Paul, Minn., which during its busy season processes between 600 and 800 rolls of film per hour for customers located in every state of the union. The installation in this firm's laboratory, believed to be one of the first to be put into a photo finishing plant, was made two years ago. It consists of a 600 cfm-capacity stationary-bed type gas-fired unit serving a drying room 20 x 12 x 10 ft. The room is insulated with aluminum-covered tar paper.

The rolls of film, coming out of the fixing solution, are delivered into the drying room on overhead tracks and allowed to hang between fifteen and twenty minutes, then are taken to the printing room. Under former conditions the film was dried with hot air which slowed up this phase of processing to between 1½ to 2 hours and, in addition, produced a more contrasty and brittle film that was hard to work with.

When dried in a dehydrated, rather than in a hot air, environment, the film produced is more tough, rubbery and elastic. It lasts longer and is easier to print.

"Because we do business on a national scale, speed in processing the film and getting delivered is essential," E. M. Reedy, head of the firm, explained. "The new drying method has proved extremely helpful in the light of the time element."

The unit installed was manufactured by The Bryant Heater Co. Contractor was the Conditioned Air Equipment Co., St. Paul, Minn.

Empresa Colombiana de Curtidos,

South American leather processers, cut processing time by air conditioning

The time required to tan leather has been cut by two weeks through the use of air conditioning equipment in the plant of the largest leather processing firm in Bogota, Colombia. This company, Empresa Colombiana de Curtidos, S.A., reports that goat, cow and sheep hides taken from the tanning rooms had required from 10 to 18 days to dry depending on the vagaries of the weather.

Now, under weather conditions controlled by air conditioning equipment, drying time is reported in a recent communication to have been cut to less than one day.

As a result of the time saved, the Bogota firm has ordered an extension of the system installed by Uribe, Garcia Alvarez y Cia, Carrier distributors in Colombia.

PROFITS IN AIR

Twelve Newspapers

report on their experiences with the air conditioning of their plants; results include improved efficiency of workers, less illness, and better appearance of the papers.

The information appearing in this article is quoted from a survey by Douglass W. Miller, Assistant to the Dean, School of Journalism, Syracuse University, and published in a recent issue of "Editor & Publisher". It is abstracted here by permission.

TWELVE newspapers throughout the United States and Canada have reported the results of air conditioning their plants or offices to Douglass W. Miller of Syracuse University. Mr. Miller, in a published statement, indicates that newspaper installations may become an important factor in the newspaper industry when plant modernization is resumed after the war.

In commenting on the survey the author said that 10 of the 12 newspapers indicated satisfaction with their use of air conditioning. Prominent among the desirable results obtained were reductions in employee illnesses such as that reported by the *Los Angeles Times* which, in its first year's experience with air conditioning, reported a decrease of 46% among the employees in illnesses serious enough to cause layoffs; improved appearance of the paper, such as that reported by the *Toronto Star* which found that the air conditioning of its rotogravure etching rooms had resulted in more accurate register; improved efficiency of the workers, such as that noted by the *Washington Star* and the *Salt Lake Tribune-Telegram.*

Only two newspapers were less than enthusiastic about air conditioning. The *Detroit Free Press,* the survey showed, is not entirely satisfied with its con-

WHAT 12 NEWSPAPERS SAY ABOUT THE AIR CONDITIONING OF THEIR PLANTS

NEWSPAPER	INDIVIDUAL REPORTING RESULTS	RESULTS REPORTED
Toronto (Ont.) *Star*	J. S. Atkinson, Vice-President	"All evidence points to better work, more work, and an increased sense of well-being on the part of members of the staff . . ."
Detroit Free Press	George W. Cunningham, Production Dept.	"All in all, the system as a whole has been fairly successful . . . Following the last revamping of the system, many of our employes appeared happier and better satisfied."
Salt Lake Tribune-Telegram	E. D. Robb	"We are convinced it has a bearing on the efficiency of our employes, especially during the extreme hot spells." Also reports improvement in appearance of paper.
McKeesport (Pa.) *Daily News*		Reports 50% decrease in employee layoffs because of colds and improvement in appearance of paper because of better press work.
Philadelphia Evening Bulletin	Robert L. Taylor, Personnel Office	". . . the medical department reports without hesitation that air conditioning has greatly improved the health of all departments having it [air conditioning]. The number of colds has been greatly decreased in those departments. The volume of work in the hot summer months has greatly increased."
Los Angeles Times	A. D. Stuart, Building Superintendent	"Control of moisture content makes the paper take ink more evenly and consequently the paper has a more attractive appearance." Reports a 46% decrease in layoff illnesses among employes during first year of operation.
Washington Star	Charles H. Ruth, Superintendent	Reports improvement in appearance of paper due to better press work. "Last summer we installed about 20 individual window type units . . . they made working conditions more pleasant."
Louisville Times and *Courier-Journal*	Lisle Baker, Jr., Treasurer	"We do think it added to the comfort, morale, and efficiency of our employes."
Pittsburgh Post Dispatch	O. J. Keller, President	"We think [air conditioning] has been of some value in promoting better health and . . . that it also promotes efficiency especially in the hot summer weather."
Scranton (Pa.) *Times*	J. W. Flanagan, General Manager	Air conditioning "has been beneficial in both health and comfort . . ."
Ottawa (Ill.) *Daily Republican-Times*	F. A. Sapp, General Manager	"Air conditioning has contributed to virtual elimination of labor turnover."
Rochester Democrat and *Chronicle*	Neal Murphy, Business Manager	"Air conditioning during the summer has helped a lot in both plants to improve working conditions . . .

ditioning system. The *Rochester Democrat and Chronicle,* which air conditioned an existing building, reports that it is somewhat doubtful if it would do this over again. This paper commented that "Our experience just about sums up to the fact that air conditioning is only perfect when planned originally in a new building by competent architects and air conditioning engineers."

Another opinion relating to the ability of those designing the system is that of the vice-president of the *Toronto Star* who said "Air conditioning is being bedeviled sometimes by unscrupulous people, the latter including sheet metal workers, who in the past have been in the business of installing ventilation ducts and who simply choose to relabel their business air conditioning instead of ventilating, and who really know nothing whatever about the real art of conditioning air.

"I think our comparatively few experiences have taught us already that in air conditioning installations the purchaser gets what he pays for. If he is prepared to pay a high price to one of the comparatively few concerns who are actually qualified to design and install air conditioning and whose guarantees are dependable, he will get a satisfactory installation, and even when dealing with first-class people of this kind, he will get what he chooses to pay for, depending upon the tolerances permitted in the contract."

Reports from the ten papers whose experiences were satisfactory are summarized in the accompanying table.

Typical of the results was that of the *Los Angeles Times* which obtained actual dollar-and-cents savings in three ways: reduced losses due to employees being off ill; increased employee efficiency; and, third, a decrease in maintenance costs in cleaning ink from walls.

Vanadium Corporation of America

builds new laboratory with exhaust ventilating system

The new chemical laboratory building at the Bridgeville, Pa., plant of Vanadium Corporation of America combines a high degree of visibility and noise-proofing with control of atmospheric dust and gases by ventilation. Air and temperature control of the laboratory rooms is facilitated by sealed walls of glass brick and glazed tile, acoustical-panel ceilings, and unusually large insulating air spaces in the walls and roof. The building is fireproof, the only exposed combustible being the wood bead securing the acoustical ceiling panels.

A perpetual positive pressure is maintained within the building, 8% more air being delivered by the heating system into the rooms than is drawn off by the hoods. This produces a flow of air outward from the analytical rooms, through doorways, stairshafts and the storeroom and basement windows, preventing entry of dust or gases from without.

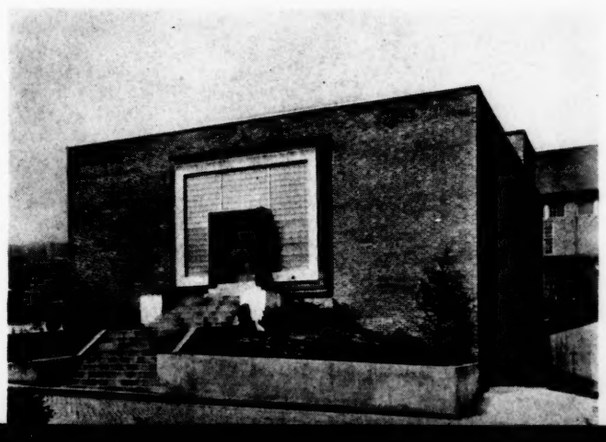
Of the large amount of air which the hoods must handle to evacuate gases, 75% is supplied by forced air introduced around the upper periphery of the hoods. Thus, only 25% is drawn from the rooms and a draft across the backs and necks of workers is avoided. To compensate the pressure loss through the hoods and to maintain an excess flowing away from the analytical rooms, air equivalent to 33% of that drawn off by the hoods is delivered through the heating system.

The hood design incorporates a double roof and double side aprons, within which adjustable baffles control both the discharge from the hood and the characteristics of the air curtain around the sides of the hood. Exhaust piping is held to a minimum to reduce maintenance due to corrosive gases and resistance in removing heavy gases. The heating system is located in the basement, while all other air-handling equipment is housed in a penthouse, which may be moved if an additional story on the building becomes desirable.

The emphasis on atmospheric control arises from the sensitivity to contamination during difficult alloy analyses.

The laboratory was designed and built under the direct supervision of O. M. Svensson, chief engineer for Vanadium Corp., by The Rust Engineering Co. of Pittsburgh.

New chemical laboratory building for Vanadium Corp. of America. Laboratory rooms have walls of glass block and glazed brick, and acoustical ceilings.



One of the large rooms in the new chemical laboratory of Vanadium Corp. of America, Bridgeville, Pa., plant, with experimental and testing equipment in use.

Tank Ventilating Power Costs Cut by Low Velocity Systems

By WILLIAM B. HARRIS

Industrial Hygiene Engineer, Division of Industrial Hygiene, New York State Department of Labor.

With the threatened shortage of electric power, and the inevitable rationing which would go hand-in-hand with it, becoming of increasing concern to business and utility executives throughout the country, anything which tends toward reduction in power consumption without impairing the process in which the power is used should be worth looking into. Such a condition, undoubtedly, is to be found in the use of low resistance exhaust systems in place of the conventional high resistance systems used almost exclusively until recently. In the accompanying article the author makes a comparative analysis of the two systems as applied to the ventilation of open tanks. The very significant power saving shown makes the subject an important one, while the analysis of equipment costs should further interest those concerned.

SHORTAGES of materials are forcing designing engineers to economize in every possible direction. In the design of industrial ventilation systems, careful adherence to sound engineering principles will often reduce the cost of both installation and operation while at the same time adding to the practical virtues of such systems. One striking example of this type of design may be found in the low resistance exhaust system described by Hatch (see HEATING AND VENTILATING, October, 1940). Hatch's paper describes a system to be used in a dusty operation. The present discussion describes a method for applying a low resistance design to the ventilation of tanks such as those used for electroplating, acid, alkali and solvent cleaning, and other operations which require the immersing of large metal parts.

Conventional Systems

The criteria usually followed in the design of ventilation for tanks where unobstructed use of the surface is required are those which have been set up for use on chromium electroplating tanks. The use of these criteria has been found to yield an air movement across the liquid surface sufficient to control the mists and vapors liberated by the operation. As usually installed, this consists of a tapered duct along each long side of the tank, opening into the upper edge of the tank in a narrow slot. The usual width of these slots is 1 in. It has been found empirically that a velocity of 2000 ft per min through the slots for a tank 3 ft in width is sufficient to give a controlling velocity across the liquid surface in the case of normal chromium electroplating.

It has also been determined that similar control obtains for tanks wider than 3 ft when the same velocity (2000 ft per min) is maintained through a slot which is increased ¼ in. for every foot of width greater than 3 ft.

The bases for this empirical rule are that (1) to maintain a controlling air movement at the center of the tank the quantity of air represented by this velocity is necessary and (2) that the entrance resistance imposed by the slot to air at this velocity is needed to give an even distribution of flow throughout the length.

The major disadvantages of this conventional method of design are:

1. It is difficult to maintain an even distribution of air velocity throughout the tank length;

TABLE 1.—VELOCITY DISTRIBUTION THROUGH SLOTS OF FIVE TYPICAL LOW RESISTANCE SYSTEMS

Tank No.	Side	Tank Width, In.	Distance From End Manifold, Inches							Average Velocity, Feet per Minute, By		
			6	12	18	24	30	48	66	Design	Test	Test After 18 Months
			Velocity, Ft. per Minute									
11	Left	72	970	—	—	950	—	950	920	925	950	950
11	Right	72	960	—	—	960	—	900	900	925	930	920
12	Left	72	840	—	—	840	—	800	780	925	815	800
12	Right	72	875	—	—	950	—	850	910	925	895	850
16	Left	72	950	—	—	940	—	920	930	925	945	810
16	Right	72	950	—	—	870	—	870	870	925	885	850
10	—	60	—	1050	—	—	900	1050	—	860	1000	980
17	—	24	1270	1100	1200	—	—	—	—	1200	1190	1000

TABLE 2.—COMPARISON OF PERFORMANCE OF LOW RESISTANCE VS. CONVENTIONAL DESIGN

Type of System	Tank No.	Hood Design[1]	Slot Dimensions, Inches	Tank Breadth, Inches	Air Volume, C.F.M.	Slot Velocity, Ft. per Min.	Surface Velocity[2], Ft. per Min.	Static Pressure Inches of Water	Fan Dia., In.	Power Consumption, Hp.
Conventional..	—	—	1¼ × 60	24	1050	2000	60	1.25	..	0.45
Low Resistance	6	1	5 × 60	24	1980	950	135	0.20	16	0.13
Conventional..	—	—	1¼ × 60	24	1050	2000	60	1.25	..	0.45
Low Resistance	10	1	5 × 60	24	1880	900	120	0.22	16	0.13
Conventional..	11	—	1 × 72	36	2000	2000	70	1.25	..	0.75
Low Resistance	15	2	3¾ × 72	36	3675	980	100	0.35	20	0.33
Conventional..	12	—	1 × 72	36	2000	2000	70	1.25	..	0.75
Low Resistance	18	2	3¾ × 72	36	3200	850	80	0.40	20	0.35
Conventional..	—	—	1 × 72	36	2000	2000	70	1.25	..	0.75
Low Resistance	16	2	3¾ × 72	36	3450	920	90	0.37	20	0.33
Conventional..	—	—	1¼ × 24	24	420	2000	60	1.25	..	0.25
Low Resistance	17	1	6 × 24	24	1200	1200	135	0.28	16	0.10

[1]Number indicates whether design is that of Fig. 1 or Fig. 2.
[2]Surface velocity in the case of the conventional system is the minimum velocity at the surface of the tank considered necessary for exhaust; in the low resistance system it is the actual minimum surface velocity as found by measurement.

2. The air distribution is obtained only by maintaining a high velocity through the slots. This means that as the fan performance becomes poorer by deterioration of the system the decrease in control will be out of proportion to the decrease in air volume;

3. Slight damage to the slot may be sufficient to close it almost completely;

4. Resistance to air flow through the system, and thus the first cost of the fan and motor and the power costs are high, and

5. The high fan and motor cost makes a multiple small unit installation uneconomical.

Low Velocity Systems

The Division of Industrial Hygiene in cooperating with industry has encountered ventilating units used for the control of mist, steam or fumes of a design fundamentally different from the conventional. The feature of these relatively unusual systems is that the air inlet slot instead of being narrow is quite wide and the air velocity through the slot is maintained at approximately 1000 instead of the usual 2000 ft per min. Reduced air velocities are employed throughout and thereby the resistance of the system as a whole is kept low. Elbows and constrictions are eliminated, and the discharge piping carried directly upward and through the roof. This piping is topped with a low resistance rain cap.

Because of the low resistances encountered in these systems, it is possible to employ a propeller fan placed directly in the piping to serve as the air mover, as shown in Fig. 1. To eliminate the necessity for narrow inlet slots and to provide uniform velocity distribution, properly adjusted vanes are introduced into the side ducts.

TABLE 3.—COMPARISON OF HORSEPOWER REQUIREMENTS FOR LOW RESISTANCE VS. CONVENTIONAL DESIGN

Tank No.	Horsepower	
	Low Resistance	Conventional
6	0.13	0.45
10	0.13	0.45
11	0.33	0.75
15	0.33	0.75
19	0.33	0.75
12	0.35	0.75
18	0.35	0.75
20	0.35	0.75
16	0.33	0.75
17	0.10	0.25
Total for 10 unit systems.....	2.74	6.40
Total for single system serving 10 tanks.....	1.52	5.75

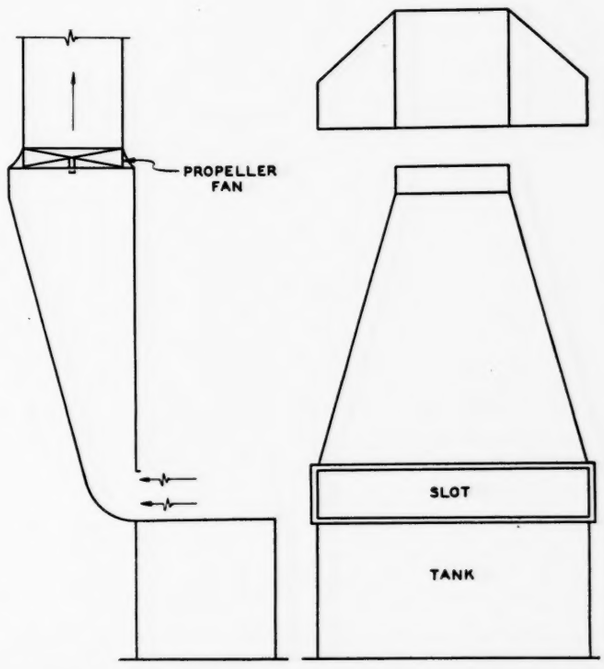


Fig. 1. Low velocity system for tank where slot is on one side of tank only. This arrangement is used when tanks are 2 ft or less in width, and placed against a wall.

Form No. 127

RESISTANCE CALCULATIONS

PLAN NO._____ FIRM_____ DATE_____

PIPE RESISTANCE (incl. controlling branch, main and discharge pipes)

SECTION OF PIPE SYSTEM	PIPE DIA. in inches	AIR VEL. in l.f.m.	V.P. in inches of water	PIPE LENGTH in feet	PIPE LENGTH in equiv't. dia's.	ELBOWS 90° NO. OF EL'S.	ELBOWS 90° EQUIV'T. DIA'S. PER EL.	ELBOWS 45° NO. OF EL'S.	ELBOWS 45° EQUIV'T DIA'S. PER EL.	TOTAL LENGTH OF EL'S. in eq'v't. dio's.	TOTAL LENGTH in equiv't. dia's.	NO. DIA'S. FOR ONE V.P. LOSS	RESIS. In terms of V.P.	RESIS. In inches of water
BRANCH	Design calculations for typical ventilating unit													
	based on exhausting 3600 CFM through two slots,													
	each $3\frac{1}{4}$" × 72"													
Turn into side manifold														
	$3\frac{1}{4}$"×72"	1100	0.062			1	45				45	45	1.0	0.062
Turn into manifold toward main														
	6"×24"	600	0.022			1	45				45	45	1.0	0.022
Turn into main														
	$13\frac{1}{2}$"×48"	800	0.040			1	45				45	45	1.0	0.040
Turn upward toward fan														
	$13\frac{1}{2}$"×48"	800	0.040			1	45				45	45	1.0	0.040
Piping to roof including transformation														
	20"	1650	0.17	25	15						45	45	0.33	0.057
			Comparison of computed system to measurements											
					CFM		H_2O		H.P.					
	Fan catalog rating				3600		0.36		0.33					
	Measured		max:		3675		0.35		0.33	(slots as installed				
			min:		3200		0.40		0.35	measured $3\frac{3}{4}$" × 72"				

HOOD RESISTANCE 1.0 V.P. loss through slot, velocity = 1000 l.f.m.	0.062
LOSS AT ENTRANCE INTO MAIN	
SEPARATOR RESISTANCE	
WEATHER CAP RESISTANCE 0.25 V.P. loss, velocity = 1650 l.f.m.	0.042
OTHER SOURCES OF RESISTANCE	
VELOCITY PRESSURE IN FAN 0.25 V.P. loss, velocity = 1650 l.f.m.	0.042
TOTAL RESISTANCE	0.367

PLAN EXAMINATION OFFICE
DIVISION OF INDUSTRIAL HYGIENE N.Y. STATE DEPARTMENT OF LABOR 11-26-'40

Calculations sheet showing method used in figuring desired resistances and velocities in various parts of the system, also the comparison of these with the values actually measured in the completed installation. Both resistances and velocities, as shown, are much less than in conventional installations.

Ten different installations designed and constructed on this low velocity principle have been studied. These installations were on tanks ranging from 2 x 2 ft to 3 x 6 ft in size. Two somewhat different low velocity designs were followed: one for tanks 2 ft or less wide placed against a wall, (Fig. 1); the other for tanks wider than 2 ft (Fig. 2) and placed away from the walls.

Table 1 shows the distribution of velocity measured at various points along the slots of five typical systems. Note the uniformity of velocity along the length of the tanks.

In Table 2 is presented a comparison of the essential design data, control velocities, and power consumption in (1) the actual low resistance systems, as tested, and (2) in the conventional systems, as computed.

These data indicate that the surface velocity obtained with the low velocity systems was far above the necessary velocity as indicated for the conventional system, so that there is a fairly large safety factor present to assure maintenance of necessary velocities even when the system deteriorates.

Because of the necessarily low resistance of the design, this system can not be employed where a high resistance collector is used to separate contaminating material. However, in the usual application for fume and mist control this is not the case.

Operating Data

In Table 3 a comparison of the horsepower requirements is given for ten tanks representing four types of installation. The figures show that a power saving of almost 60% is possible when unit systems of the low resistance design are employed as against unit systems of the conventional design. In general more than 50% of the power would be saved when the unit systems described herein are compared with a single conventional system. If, on the other hand, flexibility is not a factor, it is possible to save almost 75% of the power cost by using a single low resistance system as compared with a single conventional system. In addition to this power saving, the low resistance systems are moving 20 to 100% more air across the tank surface — a desirable condition.

First Cost

In Table 4 are given the present market construction cost figures for these systems. For the purpose of comparison, three types of design have been included. Ordinarily, such a group of operations would be ventilated by a single fan. In this way, the total cost would be considerably reduced from that for unit systems. As the figures show, supplying each tank with its own fan of the usual type would cost about $2300, whereas connecting all to a single fan would result in a cost of only $1815 or a saving of about 20%. This saving however, would be at a sacrifice of flexibility. Where systems for the type described herein are installed, it is possible to use a unit design, connect each unit to a separate fan and still save about 5% of the cost of the conventional single system.

This price difference is due almost entirely to the cost of the fans and motors, as the cost of the hoods and piping is nearly the same in each case.

TABLE 4.—COST ESTIMATES OF COMPARABLE SYSTEMS

Type of System	
Conventional Design Unit System	$2270
Low Resistance Design Unit System	1732
Conventional Design Single System	1815
Low Resistance Design Single System	Not practical

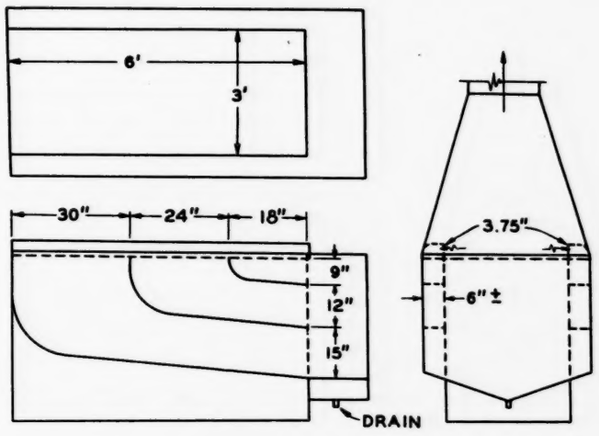


Fig. 2. Low velocity system for tank where slots are on both sides of tank. This is for tanks wider than 2 ft. Note the proportional duct sizing. used to give uniform exhaust over the entire slot length.

Summary

1. As has been shown, the sizes of slots and ducts of a tank or vat exhaust system can be increased over that of a conventional system to a point where the resistances of the slot and ducts are so reduced that, even though the air volume handled is increased, power consumption is sharply decreased—as much as 60% in the cases studied;

2. Also, since low pressures prevail, low pressure fans and smaller motors can be used, decreasing first cost for these items; and

3. With the larger slot areas in the low velocity system, slot stoppage is improbable.

Disadvantages of the low velocity system are:

a. Due to the characteristics of low pressure fans, which fall off steeply in efficiency on either side of their designed load, the resistances must be carefully calculated so as to select the right fan;

b. For the same reason, the system must be carefully maintained so as to operate at the design condition; and

c. Where the duct run is long, the increase in duct cost, due to larger areas, is somewhat proportional to the duct length and may be found to offset (2) at least to some extent.

The Fuel Oil Situation in the East

CHIEF among the June developments in the fuel oil situation along the Eastern Seaboard were:

(1) An increase in price of two cents per gallon of Nos. 1, 2, 3 and 4 fuel oils called for by OPA June 27 effective July 1; and

(2) A new survey released June 26 by Anthracite Industries Laboratory to determine the relative convertibility of domestic oil burning installations.

A previous survey (see HEATING AND VENTILATING, May, 1942) by the Laboratory indicated that the majority of installations could be converted. At the request of several Washington agencies, the Laboratory sent a major part of its staff into the field to inspect 1000 installations in an area covering New Jersey, Delaware, Baltimore, Washington, southeastern Pennsylvania, Long Island, New York City, Connecticut, Providence, Massachusetts, and five up-state New York cities from Troy to Rochester. Results of the survey were assumed to represent a reliable sample and the figures were projected to cover the million and a quarter installations estimated to lie in the affected area. These results are shown in the accompanying bar chart, from the report on the survey.†

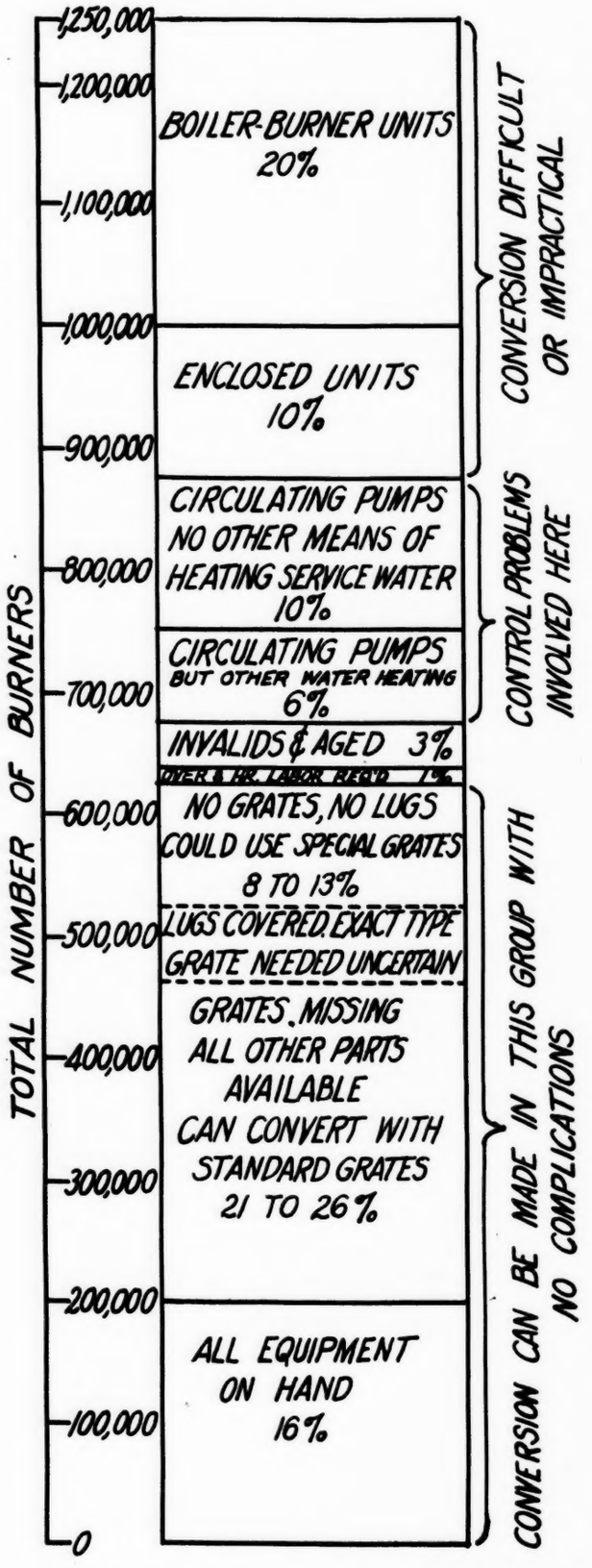
It will be noted that the bottom bracket, listing those who have all equipment on hand, shows 16%, whereas actually 23% have all equipment. This difference is due to the fact that the units between the 23% and the 16% have been dropped in one of the upper classifications, such as circulating pumps, invalids, impossible to convert, and so on.

The report gives a figure of 5.5 hr as the estimated average time of all conversions; this figure includes many difficult conversions and is, the report states, higher than typical for the lower bracket easier conversions.

The two-cent fuel oil price increase came simultaneously with an order requiring a two and one-half cent per gallon increase in gasoline prices. The reason for the increase, OPA stated, was to offset the increased cost of moving petroleum products by rail, made necessary by tanker sinkings. Apparently, however, recent severe restrictions on gasoline represent at least in part an attempt to reduce gas consumption so as to build up fuel oil stocks in the East; the price increase in gas will further aid this, while the fuel oil price increase will further force conversions.

If, as the Anthracite Industries Laboratory finds, 50% of existing oil-burning installations can be easily converted and if they are converted, the probability of cold homes on the Eastern Seaboard this winter would seem to be sharply reduced, providing that the railroads are able to move the increased amount of coal necessary. At the present time coal deliveries are lagging, it is reported, from 10 to 30 days.

†Report No. 3123 of Anthracite Industries Laboratory, Primos, Pa., from whom it is available.



Relative ease of converting the East's 1,250,000 oil burners to coal. Chart calculated progressively from top to bottom; redrawn from Anthracite Industries Laboratory report.

Atmospheric Sabotage

By F. W. HUTCHINSON

Assistant Professor of Mechanical Engineering,
University of California

AT a time when heating and air conditioning engineers are searching out and eradicating the atmospheric enemies of industrial health and efficiency there is great need for a careful reexamination of the criteria for effective ventilation. In one sense the very term "comfort air conditioning" has become obsolete in the light of recent events. *Comfort* is no longer an adequate justification or a correct description of the objectives of modern industrial air conditioning.

Conservation is possibly a more effective adjective for defining the purpose of and the need for air conditioning in its war applications. Conservation of health through alleviation of extreme conditions, conservation of wealth through reduction in rejects, conservation of time by increasing the capacity of existing plants, i.e., blast furnaces, as an alternative to the slow and costly erection of new ones; in each of these fields the heating and ventilation engineer is striving to apply the art of air conditioning to the conservation of the nation's most valuable resources.

The foremost environmental hazards to industrial effectiveness are extremes of temperature, humidity or radiation together with wide variations in any one, or all three, of these independent variables. Each of these four conditions is an enemy of employee efficiency, machine effectiveness, or product quality; in many cases two or even all three of these factors may be adversely affected by one atmospheric hazard. But serious though these hazards undoubtedly are, each of them is readily recognizable and gives immediate evidence of the damage done and therefore of the need for correction.

There is, however, a fifth type of hazard that operates without providing direct physical evidence of its presence. A veritable fifth column of the atmosphere; carbon monoxide. This deadly gas is odorless, tasteless and does not afford recognizable evidence of its action until the blood stream of the victim has become 30% to 50% saturated. With 60% to 70% saturation unconsciousness sets in and at approximately 80% death is likely to occur. While the acute effects of severe CO poisoning are direct and inescapable there is also the undefined hazard of possible unrecognizable chronic poisoning resulting from prolonged exposure to concentrations of the gas too low to produce acute effects. There is ample evidence that such exposure may be responsible for severe physiological disorders.

The present emphasis on temporary residential structures and on attaining the ultimate density of occupation in existing factory or service buildings necessarily intensifies any hazard from carbon monoxide which might normally be inconsequential. Conditioning of military vehicles, as tanks, heating of airplane cabins, ventilation of garages and hangars, are all problems which should be considered in terms of a possible CO hazard. While the public is aware that to remain in a closed garage with a car motor running or to leave uncorrected a faulty stove or furnace condition is to invite death from monoxide poisoning, the CO hazard has erroneously been thought to exist only as a cause of sudden death in small, closed, poorly ventilated rooms. This is not a correct belief.

The Maryland Department of Public Health cites the case of a man found in his car in a garage with the doors wide open to prove that the danger of poisoning exists indoors, or out, whenever faulty or inadequate ventilation permits the concentration to increase. A striking demonstration of this fact is the case of the workman who, on a sultry day, lay down 18 feet from a glowing slag pile; 15 minutes later he was discovered dead. Recent surveys show traces of CO in 50% of the moving automobiles tested and dangerous concentrations in from 5% to 7%. Since carbon monoxide in very low concentrations causes a chronic poisoning there is a possibility that a large number of people are being progressively poisoned while driving.

A conservative medical journal has suggested that children are being poisoned while playing on streets of large cities. A survey of 14 cities (19,000,000 population) involving 250 air samples showed an average contamination at busy downtown street corners of .8 part CO per 10,000 parts air. Twenty-four per cent of the samples had more than one part in 10,000, but none had as much as two parts per 10,000.

Acute poisoning is unlikely at concentrations below three parts per 10,000 but it seems probable that lower concentrations, while resulting in no immediate diagnostic signs, would nonetheless bring about a progressive or chronic poisoning. Evidence that concentrations of two parts per 10,000 have such an effect is available. The New York State Department of Labor cites one part per 10,000 as the maximum concentration of CO that should be tolerated in a room where there is eight-hour exposure.

If city streets present a CO hazard, garages offer a vastly greater one. The average concentration found in 102 tests in 27 garages is reported as 2.1 parts per 10,000; 59% of the samples contained

more than 1 part per 10,000 and 18% contained over 4 parts per 10,000. Calculations show that 5000 cfm of fresh air is required in the average garages for each idling car; a lesser amount of intake air may be satisfactory providing infiltration is effectively utilized in the unswept portions of the garage. Cars should not be allowed to idle longer than 30 seconds unless the exhaust is taken out of the building (as by means of flexible hose and coupling). The concentration of carbon monoxide in a room increases with distance from the floor so that, in designing exhaust systems, the air should be extracted near the ceiling.

Second only to automobiles are house gas appliances in the list of CO hazards. In gathering data to formulate the Baltimore Gas Appliance Ordinance, a series of tests was made of such appliances. In many cases water heaters were found to build up the CO concentration in a closed room to 7 or more parts per 10,000 and occasionally a heater of poor design would run the concentration up to 20 parts per 10,000.

The hazard of CO is found in many industries and many occupations; United States Department of Labor Bulletin No. 306 lists 52 dangerous occupations. Frequently the hazard is so well disguised that realization of its existence does not come until after an accident has occurred. During the summer of 1936 a workman was sent into an open tank to sandblast. He wore the regulation sandblast helmet and was supplied with air from a piston compressor. Shortly after entering the tank he was found dead with the helmet still on. Investigation disclosed a broken exhaust valve in the compressor which is believed to have caused overheating, incomplete combustion of the lubricating oil, and the consequent generation of carbon monoxide. The safety recommendation was that compressors for such service be equipped with temperature or CO alarms, or be of a type such that the air has no contact with oil. A somewhat similar case of poisoning by compressed air occurred on an Australian pearl boat. A diver signalled for help, was pulled to the surface and found dead. His air supply was from a compressor in the engine room of the boat and the compressor intake had been open to the engine exhaust gases.

Mass poisonings of persons in halls or churches are not uncommon. The literature records numerable cases of mass poisonings in churches, in one of which twenty persons were overcome with varying degrees of unconsciousness due to a defective stove.

Another unusual CO hazard was revealed after a number of unexplained accidents had occurred in the U. S. Navy. Men entering empty sealed compartments were frequently overcome and removed in a serious condition. Investigation disclosed that CO was produced by boiled linseed used in the wall paint and that concentrations in sealed compartments were as high as 30 parts in 10,000. The investigators concluded that "Any composition containing linseed oil, in a confined space, not only gives rise to dangerous concentrations of carbon monoxide, but will also, through absorption of oxygen during drying, produce an atmosphere markedly deficient in oxygen."

The hazard of CO in manholes has been long recognized, but has been particularly difficult to overcome because for extended periods of time no trace of the gas will be found, workers will become less vigilant and then for no apparent reason a high concentration will appear and an accident will result. Jones, Campbell and Goodwin of the U. S. Bureau of Mines investigated combustibles in Boston manholes and discovered a correlation that should be of great value. Their investigation and report did not pertain to CO, but the application to this gas of the principle which they discovered seems obvious. They found that a high rate of inflammable mixtures succeeded a period during which barometric pressure remained stationary for 18 hours; conversely, when the pressure had been rapidly rising or falling, the frequency of combustible mixtures was less. Presumably the explanation of this lies in the fact that a pressure difference induces flow; this being so it would immediately follow that the same correlation would hold for CO. While such a correlation would not permit (with any degree of safety) the foretelling of periods during which there would not be a CO hazard, it should be of great value in warning of those periods during which there would be greatest likelihood of encountering heavy CO concentrations.

The physiological effects of carbon monoxide have been thoroughly investigated and the mechanism of acute poisoning definitely established. The healthy functioning of the human body is dependent on the purification of the blood stream and this is normally brought about through the absorption, by hemoglobin in the blood, of oxygen from the inspired air. Carbon monoxide, however, has an affinity for hemoglobin 300 times greater than that of oxygen and in consequence it combines with the hemoglobin, thus excluding oxygen and leading to asphyxia. It should be noted that, in the final analysis, the cause of death is the same whether exposure is to an atmosphere containing CO_2 or CO. In case of CO_2 death results from a reduction in the amount of oxygen entering the lungs; in the case of CO the cause is a reduction in the availability of the oxygen entering the lungs.

Chronic poisoning represents a far greater potential hazard than does acute poisoning because, since warning is not present, there is greater likelihood that the conditions will not be recognized or improved. The literature contains ample evidence as to the existence and physiological effects of chronic poisoning resulting from prolonged exposure to low concentration atmospheres. Hamilton states that the symptoms of chronic poisoning are inconsistent and the condition difficult of diagnosis.

Buresch presents case histories to demonstrate the existence of chronic poisoning while Slot states that the effects of exposure to small amounts are probably neurotic and are associated with headache, irritability, emotional disturbances, and fatigue. Beck calls attention to the prevalence of chronic poisoning and discusses clinical phenomena. Brandt gives case histories of a chemist who became mentally deranged and of a kitchen maid who lost weight, had dizzy spells; he lists palpitation of the heart and reduction of sexual potency as the common signs.

Pilman gives a detailed report of repeated examinations of 36 men working in an atmosphere contaminated (concentration not given) with CO; 34 had defective vision and a progressive tendency in the visual field of the others was noted; in most cases central vision reached only 0.8. In another paper Pilman describes loss of color vision as a condition of chronic poisoning. Shillito & Drinker treat the problem of nervous and mental sequelae in acute CO poisonings. Their figures suggest that such after-effects are infrequent, but it must be remembered that in acute poisoning the exposure is of short duration; it may be that prolonged exposure to small concentrations is of much greater severity—no data are available. Walters has shown that CO depresses the rate of metabolism, the degree of depression varying directly with the degree of saturation. Jenkins demonstrates that exposure to CO raises the hemoglobin concentration; cases without headache and with no trace of CO in the blood had hemoglobin concentrations of 110.3% (Haldane scale) while those with positive symptoms had averages of 120.2%.

The United States Public Health Service has shown that daily four-hour exposure for two months to an atmosphere of 2 parts in 10,000 results in a distinct increase in both red blood cells and hemoglobin and has a deleterious effect on health. Experimental data on exposures to concentrations of less than 2 parts in 10,000 are apparently not available, but it would seem reasonable to conclude that continuous (8-hour) exposure of a long period of time might constitute a health hazard, regardless of how low the concentration might be. From the data available it does not yet seem possible to establish a lower limit to the range of hazardous concentrations. The difference between high or low concentrations is the difference between acute or chronic poisoning and this in turn is the difference between probable asphyxia or possible confinement in a mental hospital.

Conclusion

Whenever the air conditioning engineer is called on to establish "safe" atmospheric conditions, he must consider the less evident as well as the more obvious atmospheric hazards. One of the most widespread and serious dangers to industrial health and efficiency is the hazard represented by carbon monoxide. Wherever combustion processes are used care should be exercised by the ventilation specialist to insure a minimum concentration of carbon monoxide in the air of the working space.

The Climate in Yuma

A recent communication from James H. Gordon, Meteorologist of the United States Weather Bureau in Yuma, Arizona, points out that the maps on summer temperature conditions which appeared in HEATING AND VENTILATING some years ago and which have been published separately in the Air-Conditioning Engineers' Atlas, do not do full justice to the high temperatures encountered in the region in which Yuma is located. The map showing summer degree hours indicated that Yuma has an average of somewhat above 4000 degree hours per year. As a matter of fact, Mr. Gordon states, records for one year, believed to be about average, showed 25,304 summer degree hours using an 85F base. In addition, he points out that whereas HEATING AND VENTILATING's map showed that the number of hours the dry bulb temperature exceeded 85F in Yuma was approximately 1000, the actual average number of such hours in the last 12 years was 2280, with the July-August period alone running over 1000. He further mentions that the Yuma noon temperature of 100F is commonplace and that the average high is around 112F.

NUMBER OF HOURS THE DRY BULB TEMPERATURE WAS ABOVE 85F IN YUMA, ARIZONA

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	TOTAL
1930....	—	9	34	144	152	265	497	439	280	131	44	—	1995
1931....	—	—	9	147	314	381	621	461	308	125	22	—	2439
1932....	—	'	35	140	234	345	500	511	356	104	0	—	2127
1933....	—	—	20	39	159	354	572	501	385	221	13	—	2264
1934....	—	—	157	199	209	313	530	516	345	177	39	—	2485
1935....	—	—	12	84	185	433	523	482	352	126	0	—	2197
1936....	—	—	78	172	300	408	552	543	331	122	4	—	2510
1937....	—	—	21	105	231	380	536	557	409	195	21	—	2455
1938....	—	—	1	116	210	382	478	482	342	125	0	—	2136
1939....	—	—	48	179	266	385	545	526	254	128	17	—	2348
1940....	—	—	39	119	331	412	505	510	337	171	1	—	2425
1941....	—	—	0	37	272	336	562	396	266	73	28	—	1970
Means ..	—	1	38	123	239	364	535	494	330	142	16	—	2280

Mr. Gordon concludes his letter by saying that, although the figures for summer degree hours for Yuma are high, Death Valley runs a still higher number—probably in the neighborhood of 50,000 per year.

The accompanying data were calculated by Mr. Gordon and included with his communication.

Winter Heat Gains Are Important in Fuel Consumption Estimates

By CLIFFORD STROCK

The purpose of the accompanying article is to show that, judging from simple calculations, heat gains in winter are important from the standpoint of fuel consumption; their inclusion in fuel consumption estimates is suggested. The point is of particular significance where the fuel is of relatively high cost.

RARELY does the average designer or estimator give consideration to heat gains in a building when working on a winter heating project. Probably the reason is that since his primary objective is to insure comfort a factor of safety is desirable, and heat gains will constitute such a factor of safety.

This is probably right and proper. However, especially during recent years, it has become increasingly desirable for designers and estimators to make fairly elaborate estimates of fuel consumption of the heating plant, so as to arrive at a decision in selecting the most economical or desirable fuel. These estimates to be useful and to be fair to the competing fuels should be reasonably accurate, and rational methods of estimating are more and more widely used. At least some of these methods are based on using the calculated design heat loss as the starting point, so that the heat loss figure must be accurate if the fuel estimate is to be reliable. If the heat loss calculation (or installed radiator capacity) has been figured high, the fuel estimate will be high; if there are heat gains not included in the calculations the fuel estimate will be high; the heating design may be perfect with a reasonable and commendable liberality in calculation, but the fuel estimate may be high. The result is that a secondary objective of the calculation has been overlooked, the fuel estimate is high, and generally, the relatively high cost source of heat, such as gas and district steam, may be penalized in the comparison.

It is the purpose of this article, then, to attempt to show that winter heat gains may be large enough seriously to affect the fuel estimate. To accomplish this four classes of heat gains in a residence have been investigated and an attempt made to evaluate them so as to demonstrate the point in a specific case.

In the following, it is assumed that a family of four occupy a house 30 x 30 x 15 ft, located in Davenport, Iowa. The house has a calculated heat loss of 84,500 Btu per hr at design temperature. On the basis of an average outside heating season temperature, the heat loss per average hour during the heating season would be

$$\frac{70 - 40}{70 - (-10)} \times 84{,}500 = 31{,}700 \text{ Btu per hr}$$

Body Heat Loss. The four-person family consists of a father, mother and two children of school age. Taking into account the hours through the week when the father is at work, the hours the mother is occupied with household duties, those when the parents are attending social functions, church, or otherwise absent from the house, hours the children are at school or playing outside, and assuming that the whole family sleeps 8 hours per day, we arrive at a total of 144,550 Btu per week heat gain in the house. Based on a seven-day week and a 16-hour day (the sleeping hours have already been deducted) we arrive at a figure of 1290 Btu per hour heat gain from body heat alone.

Cooking. One estimate made by a manufacturer of electric ranges is that a four-person family will use an average of 92 kw hours of electricity per month for cooking, baking, and broiling.

Lights. Data published by a light bulb manufacturer shows that on an average a 100-watt bulb uses 9 kw hours per month and that a 60-watt bulb will burn approximately 5⅜ kw hours per month. Assume that the house in question has one 100-watt bulb and eight 60-watt bulbs (surely a conservative estimate), then the total electrical consumption for lighting will be 52 kw hours per month.

Other Electrical Appliances. Other common electrical appliances include vacuum cleaners, electric clocks, electric irons, oil burner or stoker, radio, refrigerator, toaster, and washer. Less common or less important appliances are sun lamps, heating pads, electric blankets, coffee makers, electric dishwashers, electric ironing machines, food mixers, extra radios, curling irons, electric razors; these will not be considered. Assuming three electric clocks, Table 1 shows the consumption in kilowatt hours per month of these appliances.

Cooking and Appliance Total. Totaling the 92 kw hr for cooking; 52 kw hr for lights, and 91 kw hr for miscellaneous appliances, the total is 235 kw hr per month or 802,525 Btu per month or, on a 30-day basis, 1115 Btu per hr heat gain from these sources.

Chimneys. Ordinarily the heat in the flue gases is considered lost. Actually this is not true in most cases of building heating. The breeching and that part of the chimney located in the basement contributes to radiation and convection heat gains in the basement. That part of the chimney which is below the roof level and adjacent to occupied rooms is undoubtedly contributing heat to the house by radiation, convection and conduction and, as pointed

TABLE 1. ESTIMATED ELECTRIC CONSUMPTION OF APPLIANCES IN RESIDENCE

Appliance	Electrical Consumption, Kw Hour per Month
Vacuum cleaner	1.5
Clocks	6.0
Electric iron	6.0
Console type radio	9.0
Electric refrigerator	64.0
Toaster	2.5
Electric washer	2.0
Total	91.0

out by the late Professor Hoffman years ago, this latter point is important enough to make it highly desirable for a building owner to have a house so built that the chimney comes up through the center of the house rather than on an outside wall. For example, for our house in Davenport with a design heat loss of 84,500 Btu per hr, the yearly fuel consumption can be estimated by the formula:

$$H_F = \frac{24 d H_h (70 - t_a)}{(70 - t_o) \times E}$$

where

H_F = the heat in Btu in the fuel as fired for the whole season.
d = number of days in heating season.
H_h = the design hourly heat loss in Btu.
t_a = the average outside temperature during the heating season.
t_o = the outside design temperature for the locality in question.
E = efficiency of the heating plant expressed as a decimal.

Assuming a seasonal efficiency (or more properly, performance ratio) of 55%, the result for the house under consideration is

$$H_F = \frac{24 \times 251 \times 84{,}500 \ (70 - 40.0)}{[70 - (-10)] \times .55}$$
$$= 348{,}000{,}000 \text{ Btu, or}$$

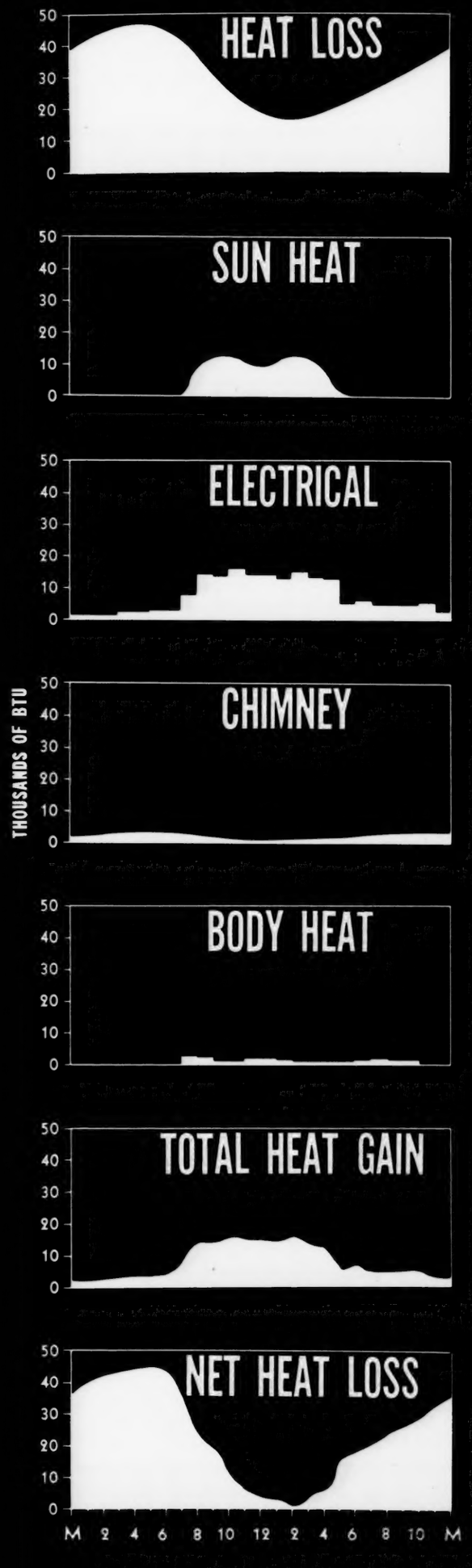
with coal at 13,000 Btu per ton, 13.4 tons.

The average quantity of coal burned per hour would be

$$\frac{13.4 \times 2000}{251 \times 24} = 4.45 \text{ lb per hr}$$

Assuming 20 lb of air per lb of coal burned, there would be 4.45 x 20 or 89.0 lb of flue gas per average hour. If the flue gas enters the stack at 500F and leaves at 100F (believed to be representative figures for soft coal), the heat lost by the flue gas in passing through the chimney is

$$.24 \ (500 - 100) \ 89 = 8550 \text{ Btu per hr,}$$



EFFECT OF WINTER HEAT GAINS

The curves at the right show (reading from top to bottom) (1) the total calculated gross heat loss for the Davenport residence, from midnight to midnight by hours, on a sunny December day when the outside temperature averages 40F; (2) the heat gain from the sun; (3) the heat gain from cooking, lighting and electrical appliances; (4) heat gain from the chimney; (5) heat gain from human beings, varying from 1 to 4 occupants through the day; (6) the total heat gain from (2) to (5) incl.; and (7) the net heat loss resulting from deducting (6) from (1).

TABLE 2. RELATIVE INTENSITY OF SUN HEAT BY TIME OF DAY

(Based on 300 Btu per hr per sq ft at Noon Aug. 1; figures based on curve in 1942 *Guide*†)

Time	I = Btu per Sq Ft per Hr	Relative Intensity
6 a.m.	120	.40
7 "	200	.67
8 "	250	.83
9 "	270	.90
10 "	290	.96
11 "	295	.98
N	300	1.00
1 p.m.	295	.98
2 "	290	.96
3 "	270	.90
4 "	250	.83
5 "	200	.67
6 "	120	.40

†For simplification in calculations, the figures during afternoon hours were adjusted slightly to make the curve symmetrical.

TABLE 3. INTENSITY OF HEAT BY MONTH AT NOON

(Based on 300 Btu per hr per sq ft at Noon Aug. 1; Column 1 from Smithsonian Physical Tables, 1934*)

	Relative Intensity	Btu per Hr per Sq Ft
January	.117	106
February	.150	136
March	.204	185
April	.269	244
May	.320	291
June	.349	318
July	.352	320
August	.330	300
September	.285	260
October	.225	205
November	.164	149
December	.124	113

*Column 2 was set at 300 for August. For other months the value in Col. 2 is in proportion to the figures in Col. 1.

where .24 is the specific heat of the flue gas.

This heat can be lost only through the chimney walls. If it is located, as most chimneys are, half on the outside of the house, assume that three quarters of the heat is lost to the outside air, and one-quarter is conducted into the house. Then the heat gain would be

$$\frac{1}{4} \times 8550 = 2137 \text{ Btu per hr.}$$

Sun Heat. The data for estimating solar heat gains in winter are not in too good a shape. The angle between the sun's rays and a given wall for each month can be determined from readily-available data. The average number of sunny hours for each month for a given location are available from weather bureau records. Unfortunately, these data show only the number of hours the sun is strong enough to affect the recording instrument, and do not differentiate among the various intensities of sunshine. Further, no reliable figures are at hand to determine the hourly value of the sun's intensity during winter months. Consequently, the method used here was (1) to use the hour-by-hour curve for sun heat intensity in Pittsburgh for August 1 as measured by Houghten with a pyroheliometer and reported in the ASHVE *Guide,* and use the ratio of the value given for each hour to that at noon as the relative hour-by-hour intensity the year round (Table 2); (2) to use a table showing relative intensities by months (from the Smithsonian Physical Tables) as being probably reasonably close to representing actual conditions; (3) to multiply the high noon value on August 1 (300 Btu per sq ft per hr) by monthly index, to determine the noon value for each month (Table 3); (4) to multiply these values by the hourly index, and finally (5) to multiply the resulting figures for each hour and each month by the cosine of the angle between the sun's rays and the walls and roof.

This gave a set of four tables (south, east, and west walls, and roof) with a figure for each hour and each month representing the heat impinging on the surface in Btu per hour per square foot. It was assumed that there were 256 sq ft of glass, that the glass transmitted 90% of the heat impinging, that the walls transmitted 3% of the heat impinging, and the roof (dark color) 4.5% of the heat impinging. The total transmitted heat was calculated at 23 million Btu per year or 3830 Btu per average hour.

Results. We are now in a position to total all of the calculated heat gains and compare them with the calculated heat loss:

	Heat per average Hour, Btu	
Heat loss		31,700
Heat gain from body heat	1290	
Heat gain from cooking, lights, and appliances	1115	
Heat gain from chimney	2137	
Heat gain from sun	3830	
Heat gain, total		8,372
Net heat loss		23,328

The result is that we have cut the estimated heat loss by 26.4%, so that our estimated fuel consumption would be not 13.4 tons but approximately 9.8 tons per year. This would in turn decrease our estimated heat gain from the chimney to 1570 Btu per hour, giving a revised net heat loss of 23,895 and a revised fuel consumption of 10.1 tons. Consequently, by considering the heat gains our estimate has been reduced 24.6%.

Conclusions. There may be and probably are some faults to be found with these results. For one thing, perhaps our calculated heat loss is still low, for the standard method does not include an allowance for infiltration when doors are opened. Probably our estimate of sun heat gain is faulty, especially in the use of existing data on number of sunny hours and assuming all these hours at the same sun intensity. Our method of calculating heat gain from the chimney may be too liberal and finally, perhaps, due to tradition, it does seem silly to include body heat.

On the other hand, even if every item in the estimate were cut to one-third its amount, the estimated fuel consumption computed by the rational method would be 1/3 x 24.5 or 8.2% too high. Consequently, the final conclusion would be that more consideration might well be given to winter heat gains *in making the fuel estimate* (not the equipment sizing), especially where high cost fuels are being considered.

WASHINGTON NEWS

summarized by Loring F. Overman. WPB Issues Interpretation of L-38; Controls Considered in Conservation; Construction at $12.5 Billion Rate.

The enemy continued during June to take increasing toll of coastwise shipping, reducing oil supplies to the point where the War Production Board was forced to authorize the construction of a 550 mile oil pipe line from Texas to Illinois.

The announcement of the pipe line was expected to have a psychological effect upon the public which might interfere with the conversion drive. But Petroleum Coordinator Ickes issued a statement to the effect that although the pipe line would make a substantial contribution to the oil supply it would not completely solve the heating problem this winter for The Eastern Seaboard.

Controls and Conservation

In connection with the conversion drive, control manufacturers conferred with the Plumbing and Heating Branch to discuss the part temperature controls might have in the program. If it can be demonstrated that controls can make substantial savings in fuel supplies WPB may allocate critical metals for their manufacture.

In order to make a case for allocation the advisory committee of control manufacturers will assemble data to show savings in terms of tons of coal as against expenditure of pounds of metal for manufacture of controls. The committee will meet in Washington in the early part of July to submit the required data. If the material collected is sufficiently conclusive it will be used as a basis for asking increased allocations of metal for controls.

PRP Takes Over

A limited allocation system became effective July 1 whereby all companies using over $5,000 worth of metals quarterly were required to make application under the PRP plan for their requirements during the third quarter of this year.

The plan goes into operation under Priorities Regulation No. 11 announced June 10. The regulation provides for establishing definite quantitive limits to the acquisition of metals and other scarce materials by any person or company using more than $5,000 worth of metal in a calendar quarter. For the present. that is, the third quarter, the primary emphasis will be on the distribution and use of metals. Wholesaling, retailing and warehousing operations are excepted.

A joint statement by William L. Batt, chairman of the Requirements Committee of the War Production Board, and J. S. Knowlson, Director of Industry Operations, declared:

"The huge requirements of the growing war production program make it necessary to institute much stricter controls over the use of metals and other scarce materials. The priorities system as it was developed last year as a means of giving preference to defense orders no longer provides adequate control. . . . It should be emphasized that the Production Requirements Plan under this program will no longer be primarily a mechanism for the assignment of preference ratings to each applicant on the basis of the rated orders the applicant has on his books. PRP now becomes the chief means by which the War Production Board will execute general policies. The emphasis from now on will be on the end use of materials rather than on preference ratings."

"Air Cooled" Tanks

The War Department recently referred all inquiries concerning the use of air conditioned American tanks in Libya to a British statement about this point. The Germans, fishing for information concerning American tanks used by the British, as usual went overboard with the claim that their own desert panzers were air conditioned to withstand temperatures of 160 to 180F. The British did not attempt to go them one better but issued the statement that the only air conditioning in any tanks used in Libya was confined to the air cooled engines in the American tanks. This is offered by the War Department as the final word on the subject.

Construction at $12 1/2 Billion

The present rate of war construction is about $12,500,000,000, a year, WPB announces. By the end of the year it is expected to reach $13,500,000,000. Of construction put in place in mid-June all but 22% was for airports, war plants, camps, shipyards, war housing, and the like.

What lies ahead for housing under the war program was recently forecast by Joseph L. Weiner, Deputy Director of the Division of Civilian Supply, economist and policy-maker, second only to Henderson.

"We will have to re-examine the housing situation," said Mr. Weiner, "in order to make certain that all available space in so-called critical defense areas is being utilized. The demands of the war program upon our output of steel are going to make it impossible for us to build homes in areas where adequate housing facilities already exist, but have not been put to work because of reluctance on someone's part to make them available. Compulsory billeting of war workers has been resorted to in England. In that country, unoccupied houses have been commandeered. These two methods furnish means of solving housing problems, but I hope they will not have to be adopted here."

100,000 Housing Units

More than 100,000 war housing units have been declared "the most essential" and restrictions on lumber deliveries under Limitation Order L-121 lifted to complete their construction.

The 100,000 units involved are divided almost equally between those publicly-financed and privately-financed. In the former classification are 76 projects in 25 states, covering 54,039 units. The privately financed projects include 51,350 units in 32 localities in 20 states.

Limitation Order L-121, issued May 13, prohibited sales of construction lumber by large producers for a period of 60 days with the exception of sales and deliveries to the Army, Navy, and Maritime Commission.

A special authorization clause now takes care of the needs of the essential projects. The authorization covering the publicly financed housing permits the purchase and delivery of construction lumber needed for the completion of a list of specified projects. The Federal Public Housing Authority superintendent for each project must certify the necessity for the lumber being bought under this authorization. The auth-

orization covering the privately financed housing is similar. However, since the individual projects could not conveniently be specified, both the contractor and an authorized agent of the FHA are required to certify the necessity for the lumber being bought under his authorization.

WPB officials emphasized that the present demand for lumber of certain kinds greatly exceeds the supply, and that housing contractors who receive authorization to purchase lumber in accordance with the present plan cannot expect prompt deliveries in every case.

Construction Bureau Moves

The Bureau of Construction, recently created to coordinate all construction functions of WPB, moved to New York in June and set up headquarters in the Empire State Building. The Bureau is divided into five branches: Project Analysis Branch, handling all applications for private construction, recommends priority ratings; Materials Control Branch reviews the use of materials in projects which have been designated as essential by the Project Analysis Branch; Project Service Branch works closely with industry and with the Army, Navy, and other Government Agencies to eliminate construction delays; Housing Branch recommends priority ratings for publicly and privately financed war housing; and Consultation Branch acts as liaison between the public and the Bureau. It interprets the needs and problems of the construction industry and recommends procedures consistent with the over-all war program.

P-84 Amended

Under an amendment to P-84 issued during June, installation of equipment calling for more material than that being replaced is permissible, if the substitution is one of less critical material for that which is more critical.

The amendment which was issued in the form of an interpretation, declares that the prohibition against a substitution "more extensive than that which is necessary to replace" worn-out or damaged parts does not mean that the identical part or parts must be replaced.

Installations calling for a different kind of equipment are not necessarily more extensive within the terms of the order, if the new parts do not contain a greater weight of metal. For instance, coal-burning equipment is a permissible replacement for oil-burning or gas burning equipment.

In explaining that a material less critical may be used for replacement, the interpretation says that "where steel equipment is replaced by cast iron equipment, the substitution is not 'more extensive' even though the substituted equipment be heavier than that replaced. Similarly, a substitution of iron and steel equipment for copper or copper base alloy is not a 'more extensive' substitution even though the substituted equipment be heavier than that replaced."

Service Charges Frozen

The charges for services rendered in connection with the installation or repair of a commodity were frozen to their highest March level as of July 1 under the General Maximum Price Regulation. This affects all air conditioning and heating repair services. Engineering firms (consulting) other than those engaged in the sale of equipment or in contract construction are excepted. The fees and charges of architects are also included in the exemption.

L-38 Relaxed

Restrictions placed upon manufacturers and distributors of industrial and commercial refrigerator and air-conditioning equipment by L-38 were relaxed under Amendment 1 to the order issued June 20.

Main provision of the amendment releases for sale by dealers and distributors carbonated beverage dispensers, bottled beverage coolers, low temperature mechanical refrigerators, self-contained room coolers, fountainettes, florist boxes, and ice cream cabinets. Under the original terms of the order these could be sold only on an A-9 or higher preference rating. It is now no longer necessary to obtain a preference rating to cover the installation of the finished product.

The sale of all other unused refrigerating and air conditioning equipment can be made only to fill a preferred order. Added to the preferred order group are Army exchanges, Naval ship-stores, officers' messes, and officers', non-commissioned officers', and enlisted men's clubs.

Added to the list of items which may no longer be manufactured, save on direct Army or Navy orders, are ice cream cabinets and evaporative coolers. All producers' inventories of items under Paragraph E of the original order and including ice cream cabinets and evaporative coolers, remain frozen.

Draft beer coolers remain frozen and dealers', distributors' and manufacturers' inventories must be reported to WPB.

Fabricated parts and sub-assemblies may now be assembled into finished products if no further raw materials are consumed in the process. This does not affect the Paragraph E items.

All appeals for relief from the stop-production provision must be made on Form PD-520.

Sterling F. Smith, administrator of the order for the Air Conditioning and Commercial Refrigeration Branch, said that there will be no further relaxation of the prohibition against sales without rated certificates.

P-126 To Be Amended

Spokesmen for the Air Conditioning and Commercial Refrigeration Branch have revealed that it is now contemplated to revise P-126 so that replacements and repairs will be permitted under an out-and-out rating. The order as it now stands is complicated by a number of ratings based upon the urgency of repair.

Explanation of L-38

The Air Conditioning and Commercial Refrigeration Branch of WPB, in response to numerous requests, on June 25 issued the following series of questions and answers on the operations of General Limitation Order L-38, which controls the production and distribution of air conditioning and commercial refrigeration equipment. [Interpretations not covering air conditioning have been omitted—Editor.]

(1) Q. The sale and installation of what unused refrigerating and air conditioning equipment may be made without first obtaining a preferred order?

A. A dealer or distributor, but not a producer, may sell or install the following types of equipment without first receiving a preference rating from the buyer, provided such equipment was in his inventory or in transit to him on June 15, 1942: Carbonated beverage dispensers; bottled beverage coolers; low temperature mechanical refrigerators having a capacity of less than 8 cu ft; self-contained room coolers, evaporative coolers and window-type air conditioners; fountainettes; florist boxes and display cases; and ice cream cabinets. The sale of all other unused refrigeration and air conditioning equipment can be made only to fill a preferred order.

(2) Q. What is meant by unused refrigerating and air conditioning equipment?

A. All such equipment which has never been sold *and* delivered to the ultimate consumer. This includes repair parts for such equipment, but the sale of such parts without a preference rating is permitted provided they are to be used in emergency repair service as defined in the order.

(3) Q. What is meant by preferred order?

A. Any order for the account of designated governmental departments or bureaus; any order for a foreign country pursuant to the Lend-Lease Act; any order bearing a preference rating of A-9 or higher assigned specifically to the delivery of refrigerating and air conditioning equipment and designating the person to receive it; or any order to which has been assigned a preference rating by operations of Preference Rating Order No. P-126.

(4) Q. What restrictions are placed on the production of refrigeration and air conditioning equipment by Limitation Order L-38 and Amendment No. 1 thereto?

A. In the period May 15 to June 30, 1942, a producer may manufacture or assemble that equipment for which he has unfilled preferred orders, or the number of items of such equipment delivered on preferred orders in the period April 1 to May 15, 1942, whichever is greater.

Amendment No. 1 provides that all producers may assemble any item of equipment other than those products listed in paragraph (e), from fabricated parts in their inventory as of May 15, 1942. This right expires June 30, 1942.

In the calendar quarter beginning July 1, 1942, a producer may manufacture or assemble that equipment for which he has unfilled preferred orders, or the number of items of such equipment delivered on preferred orders in the past calendar quarter, whichever is greater.

(5) Q. Does the order cover the sale of repair parts?

A. Yes, but any repair part may be sold without any preference rating if it is to be used in emergency repair service as defined in the order.

(6) Q. What is the proper procedure to follow in obtaining a preference rating for refrigeration and air conditioning equipment?

A. The customer desiring to purchase such equipment must file Form PD-1A with the War Production Board, Washington, D. C., requesting a preference rating of A-9 or higher. The application will be denied unless it clearly appears that the equipment will be used for a purpose essential to the war effort or for an essential civilian need. For example, a rating will be granted for the preservation of food or to a testing laboratory where necessary but will not be granted to enable retail establishments or theaters to obtain air conditioning equipment. A buyer having a preference rating of A-9 or higher is free to buy such equipment as covered by the rating certificate, and the seller is free to sell and install such equipment.

(7) Q. May a producer or a distributor who has a stock of refrigeration and air conditioning equipment sell such equipment to dealers?

A. Yes, except for the items listed in answer to question 1 above, but repair parts for all equipment may be sold by a producer or distributor to a dealer.

(8) Q. Can the installation of commercial refrigeration equipment not pursuant to a preferred order be made where payment or partial payment had been made prior to the effective date of Limitation Order L-38, but the installation had not been started?

A. No. A preference rating of A-9 or higher is needed to make the installation.

(9) Q. Where an installation had been started prior to the issuance of Limitation Order L-38, may it be completed without obtaining a preference rating of A-9 or higher?

A. No. A rating of A-9 or higher is necessary to complete the installation.

(10) Q. Does application have to be made on Form PD-1A for the right to buy any commercial refrigeration equipment no matter how small the order may be?

A. Yes.

(11) Q. Where a manufacturer had an order for equipment bearing a preference rating of A-9 prior to the issuance of Limitation Order L-38, may he install such equipment without violating the terms of the order?

A. Yes.

(12) Q. May an unfilled order on hand as of May 15, 1942, bearing a rating lower than A-9, be installed without violating the terms of the order?

A. No. Before the installation can be made, a preference rating of A-9 or higher must be obtained.

(13) Q. May ice cream cabinets owned by an ice cream manufacturer be installed without first obtaining a preferred order?

A. Yes, provided they were in the inventory of such manufacturer or in transit to him on June 15, 1942.

(14) Q. May bottled beverage coolers and dispensers owned by a bottler of carbonated beverages be installed without first obtaining a preferred order?

A. Yes, provided they were in the inventory of such bottler or in transit to him on June 15, 1942.

(15) Q. May air conditioning units of less than 2 hp be rented by a dealer without first obtaining a preferred order?

A. Yes, provided they were in the inventory of such dealer or in transit to him on June 15, 1942.

(16) Q. Does equipment installed "on trial" prior to May 15, 1942, and still "on trial" on that date come within the provisions of the order?

A. Yes, for the reason that the sale had not been completed prior to that date, which was the effective date of the order.

(17) Q. May refrigeration and air conditioning equipment held by a dealer for display purposes be sold without obtaining a preferred order?

A. No, as the equipment is considered as "unused" as defined by the order.

(18) Q. May a manufacturer obtain additional material with which to make refrigeration and air conditioning equipment?

A. Yes, by filing Form PD-25A, but he must stay within the production limitations of the order.

(19) Q. Where a buyer of refrigeration or air conditioning equipment has a rating of A-9 or higher, which is not sufficient to obtain the needed equipment, what is the next move of the buyer?

A. The buyer with such a rating should explore the markets for a seller who can fill his order. If he is unsuccessful, a new application should be filed explaining the circumstances.

(20) Q. Do evaporative coolers come within the scope of Limitation Order L-38?

A. Yes.

(21) Q. Are stone crock water coolers, where the temperature is lowered by the evaporation of moisture passing through the stone or by the immersion of ice in the contents, covered by L-38? A. No.

(23) Q. Where the ultimate consumer had on hand all of the products and installation parts necessary to the installation, prior to the effective date of the order, and for which he had been billed, is it permissible for him to complete the installation? A. Yes.

(24) Q. If an installation was in progress on the effective date of the order but additional installations were required after the effective date, may a producer supply the additional equipment and supply labor to complete the installation in the absence of a preferred order?

A. No. Form PD-1A must be filed and a preference rating of A-9 or higher obtained before the installation may be completed.

25. Q. May an ultimate consumer accept delivery of a shipment of refrigeration or air conditioning equipment in transit to him on the effective date of the order?

A. Yes. However, before it can be installed, a preference rating of A-9 or higher must be obtained.

26. Q. Do provisions of General Limitation Order L-38 apply to materials and equipment produced for export under the terms of an exporting license?

A. Yes. The exporter must file Form PD-1A.

WASHINGTON BRIEFS

BOILERS AND RADIATORS. An Industry Advisory Committee for the Cast Iron Boiler and Radiator Industry was announced by WPB on June 15 as follows: R. E. Daly, American Radiator & Standard Sanitary Corp.; V. A. Good, sales manager, Burnham Boiler Corp.; L. N. Hunter, vice-president, National Radiator Co.; John P. Magos, Crane Co.; J. F. McIntire, vice-president, United States Radiator Corp.; H. F. Randolph, vice-president, International Heater Co.; Stanley K. Smith, vice-president, The H. B. Smith Co., Inc.; Lester O. Stearns, vice-president Columbia Radiator Co.; and W. R. Stockwell, Weil-McLain Co. W. W. Timmis is Government Presiding Officer.

FUEL OIL SAVINGS. Voluntary conversions by East Coast consumers of heavy fuel oil continue to shoot upward, with a total of more than 15,600,000 barrels being saved annually by 446 firms reporting by May 27, the Office of Petroleum Coordinator Harold L. Ickes announced June 4. This is an increase of 2,300,000 barrels since May 18, when 368 concerns burning 13,500,000 barrels per year had converted. Deputy Coordinator Ralph K. Davies estimated that probably another 12,500,000 barrels a year can ultimately be saved by further conversions. About 135,000,000 barrels of heavy oils are normally used by East Coast industries, apartment houses, hotels, and other consumers.

ESSENTIAL BUILDING. A yardstick for measuring all building operations in the Northeastern States for the duration of the war is offered to all public and private agencies and individuals contemplating construction programs by Regional Director (New York) John M. Gallagher of the Federal Works Agency. It covered five points: (1) Immediate construction is essential to the war effort; (2) it is not practicable to rent or convert existing facilities for the same purpose; (3) the construction contemplated would not duplicate or unnecessarily expand facilities now available; (4) all possible economies have been effected through drastically simplified design, elimination of non-essentials and limiting the use of metals to an irreducible minimum; and (5) labor and materials are immediately available for construction.

CONSTRUCTION. On June 6 WPB issued a series of interpretations of Conservation Order L-41, which placed all construction under rigid control. The interpretations deal with various classes of construction, cost estimates and design changes.

HEAT EXCHANGERS. Steps were taken June 27 by the newly organized Heat Exchanger Industry Advisory Committee to seek facilities capable of producing $200 million worth of heat exchangers needed in the war program before July 1, 1943. During 1941 the industry, comprising fifty-three companies, produced heat exchangers valued at $60 million; present facilities can produce only about $80 million worth in the required time, leaving a deficit of approximately $120 million. The Committee agreed that extensive conversion of other industries will be necessary to complete the job. It is expected that considerable capacity will come from the railroad industry, refrigerator industry, radiator industry and machine shops. Attention is being given to plans to standardize and simplify designs. In this connection the industry's two large associations, the Tubular Exchange Manufacturers Association and the Heat Exchanger Institute, have been asked to submit recommendations for Government war-time standards to conserve materials and increase production.

P-84 INTERPRETATION. Installation of equipment calling for more material than that being replaced is permissible under the Plumbing and Heating Repair and Maintenance Order (P-84), if the substitution is one of less critical material for that which is more critical. This is made clear by Interpretation No. 1, issued June 1, which also declares that the prohibition against a substitution "more extensive than that which is necessary to replace" worn-out or damaged parts does not mean that the identical part or parts must be replaced. Furthermore, installations calling for a different kind of equipment are not necessarily more extensive within the terms of the order, if the new parts do not contain a greater weight of metal. For instance, coal burning equipment is a permissible replacement for oil burning or gas burning equipment. In explaining that a material less critical may be used for replacement, the Interpretation says that "where steel equipment is replaced by cast iron equipment, the substitution is not 'more extensive' even though the substituted equipment be heavier than that replaced."

PATENTS. All persons claiming any interest in patents or patent applications now or formerly owned by nationals of designated foreign countries must report their interest including any license agreement or claims of ownership, by August 15, according to Leo T. Crowley, Alien Property Custodian.

STOKERS. WPB on June 4 acted to speed the conversion of oil-burning equipment to coal by permitting the assembly of small stokers from materials which were in manufacturers' hands on May 31. At the same time, W. W. Timmis, Chief of the Plumbing and Heating Branch, announced the creation of an Operations Section which will continue an overall study, underway in the Branch for some time, of the various problems involved in the conversion of oil burners to use of other fuels. Permission to assemble small coal stokers is contained in Amendment 1 to Limitation Order L-75. The original terms of the order ended the production of such stokers on May 31. The amendment, which was approved by the Office of Petroleum Coordinator and the Office of Solid Fuels Coordinator, permits the assembly until September 30 of small stokers composed wholly of fabricated parts in a manufacturer's physical possession on the former cut-off date. The Plumbing and Heating Branch estimated that about 8,000 stokers will be assembled under the terms of the amendment. The new operations section of the Branch, which will be headed by Henry S. Norris, of Adamstown, Md., will have the major responsibility of handling the demand for stokers, grates, and other equipment needed for conversion to coal. Mr. Norris, a graduate of Princeton University, has been a partner in the Nassau Engineering Co., Glencove, L. I., and prior to that was connected with the American Radiator Company. All stokers have recently been released from the freeze provisions of Limitation Order L-79, making an estimated 70,000 units available for conversion purposes.

CONTROLS. An Industry Advisory Committee for the Temperature and Combustion Control Industry was announced June 15 by T. Spencer Shore, Chief of the Bureau of Industry Advisory Committee. Committee members are: A. D. Cole, president, Cole-Sullivan Engineering Co.; M. W. Crew, manager, Hotstream Heater Co.; E. E. Hardwood, manager, White-Rodgers Electric Co.; H. T. Kucera, vice-president, Marsh-Tritrol Co.; A. R. Herske, president, Au-Temp-Co. Corp.; J. C. Matchett, vice-president, Illinois Engineering Co.; J. W. Pauling, vice-president, Minneapolis - Honeywell Regulator Co.; M. F. Rather, Johnson Service Co.; W. G. Van Etten, vice-president, Conco Engineering Works; Warren Webster, Jr., president, Warren Webster & Co.; and E. H. Ziebold, manager, Cook Electric Co. W. W. Timmis is Government Presiding Officer.

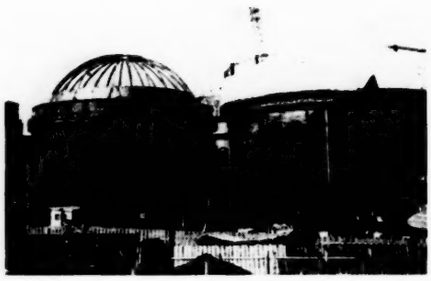
Number of Degree-Days for May, 1942

City	Deg.-Days May, 1942	Deg.-Days May, 1941	Degree-Days Season 1941-42 Sept. 1-May 31
Albany, N. Y.	162	227	6374
Alpena, Mich.	407	298	7174
Anaconda, Mont.*	664	714	7761
Atlanta, Ga.	25	25	2920
Atlantic City, N. J.	114	139	4437
Baker, Ore.	506	366	7036
Baltimore, Md.	21	61	3802
Binghamton, N. Y.	183	246	5994
Birmingham, Ala.	19	13	2591
Bismarck, N. D.	449	229	7962
Boise, Idaho	384	234	6139
Boston, Mass.	164	199	5388
Bozeman, Mont.*	647	692	8139
Buffalo, N. Y.	283	324	6286
Burlington, Iowa	183	—	4481
Burlington, Vt.	199	326	7274
Butte, Mont.*	683	765	8536
Cairo, Ill.	60	26	3733
Canton, N. Y.	225	282	7474
Charles City, Iowa	299	120	6690
Charlotte, N. C.	13	33	2879
Chattanooga, Tenn.	32	35	3513
Cheyenne, Wyo.	504	336	7438
Chicago, Ill.	233	172	5547
Cincinnati, Ohio	118	94	4555
Cleveland, Ohio	182	177	5374
Columbia, Mo.	126	34	4495
Columbus, Ohio	138	120	4912
Concord, N. H.	214	322	6887
Concordia, Kan.	178	48	5112
Davenport, Iowa	182	75	5526
Dayton, Ohio	135	123	4928
Denver, Colo.	297	158	5933
Des Moines, Iowa	203	69	5737
Detroit, Mich.	226	176	5809
Dodge City, Kan.	168	53	4828
Dubuque, Iowa	228	97	5921
Duluth, Minn.	542	397	8229
Eastport, Me.	505	520	7498
Elkins, W. Va.	152	242	5282
El Paso, Tex.	1	15	2390
Erie, Pa.	215	212	5612
Escanaba, Mich.	468	331	7548
Evansville, Ind.	106	74	4417
Fort Smith, Ark.	38	0	3131
Fort Wayne, Ind.	200	169	5827
Fort Worth, Tex.	11	1	2386
Grand Rapids, Mich.	215	162	5813
Green Bay, Wis.	334	205	6822
Greensboro, N. C.	36	75	3683
Harrisburg, Pa.	64	110	4836
Hartford, Conn.	120	199	5662
Helena, Mont.	509	328	8473
Huron, S. D.	352	124	6953
Indianapolis, Ind.	131	106	4795
Ithaca, N. Y.	217	257	6150
Kansas City, Mo.	134	27	4468
Kewanee, Ill.	103	39	5047
Knoxville, Tenn.	47	46	3536
La Crosse, Wis.	278	110	6419
Lander, Wyo.	478	288	8395
Lansing, Mich.	258	205	6250
Lewiston, Me.	263	315	7210
Lincoln, Neb.	210	53	5534
Little Rock, Ark.	33	0	3012
Livingston, Mont.*	599	663	7015
Los Angeles, Calif.	98	27	1328
Louisville, Ky.	103	68	4094
Lynchburg, Va.	18	72	3547
Madison, Wis.	283	145	6484
Marquette, Mich.	486	320	7418
Memphis, Tenn.	33	10	3260
Milwaukee, Wis.	330	236	6539
Minneapolis, Minn.	290	132	6847
Nantucket, Mass.	275	309	5424
Nashville, Tenn.	50	35	3454
New Haven, Conn.	139	166	5230
New Orleans, La.	1	0	1350
New York, N. Y.	82	121	4703
Nome, Alaska	1146	1132	10,247
Norfolk, Va.	5	46	3010
Northfield, Vt.	262	388	7708
North Platte, Neb.	279	95	6116
Oklahoma City, Okla.	67	8	3402
Omaha, Neb.	217	60	5794
Oswego, N. Y.	270	321	6406
Parkersburg, W. Va.	125	132	4573
Peoria, Ill.	174	89	5340
Philadelphia, Pa.	43	79	4296
Pittsburgh, Pa.	110	146	4778
Pocatello, Idaho	487	292	7716
Portland, Me.	328	317	7006
Portland, Ore.	249	216	4075
Providence, R. I.	124	175	5304
Pueblo, Colo.	193	142	5788
Raleigh, N. C.	11	47	3024
Reading, Pa.	70	105	4720
Reno, Nev.	417	270	5834
Richmond, Va.	7	63	3535
Rochester, N. Y.	217	254	6304
Roseburg, Ore.	276	216	4023
St. Joseph, Mo.	172	34	4943
St. Louis, Mo.	91	29	4168
Salt Lake City, Utah	378	139	6334
Sandusky, Ohio	176	149	5388
San Francisco, Calif.	267	151	2403
Sault Ste. Marie, Mich.	493	374	8331
Scranton, Pa.	123	190	5586
Seattle, Wash.	262	240	4103
Sioux City, Iowa	273	73	6432
Spokane, Wash.	380	293	6430
Springfield, Ill.	122	47	4753
Springfield, Mo.	160	36	4478
Syracuse, N. Y.	219	263	6279
Tacoma, Wash.	291	276	4470
Terre Haute, Ind.	118	80	4637
Toledo, Ohio	193	141	5627
Trenton, N. J.	61	114	4709
Utica, N. Y.	195	258	6597
Washington, D. C.	23	89	2900
Wichita, Kan.	149	28	4483
Yakima, Wash.	221	219	5372

Figures in this table, with eight exceptions, are calculated by HEATING AND VENTILATING from local weather bureau reports. Exceptions are Utica, Lewiston, Kewanee, and Sioux City, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y.; Norman E. Ross, Bursar, Bates College, Lewiston, Me.; J. M. Hartman, Engineering Department, Kewanee Boiler Corp., Kewanee, Ill., and Alfred R. Wagstaff, Engineer, Sioux City Foundry and Boiler Co., Sioux City, Iowa, respectively; Anaconda, Bozeman, Butte and Livingston, Mont., through the courtesy of the Montana Power Company. HEATING AND VENTILATING will welcome an opportunity to make arrangements with readers who are keeping degree-day records over a period for important communities not listed above in order to make such data available to the industry.

*These figures are for April, 1942; April, 1941; and Season 1941-42 to April 30, respectively.

Liquefied Natural Gas Stored in Tanks at −258F



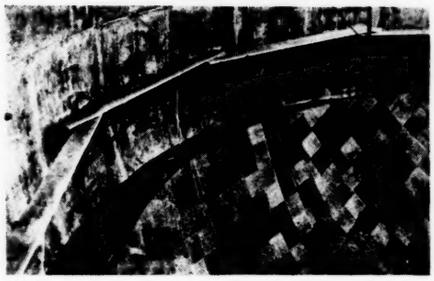


Fig. 1. (Left) The tanks in the process of erection. There are two tanks or shells in each unit, one shell within the other. The outer shell is 60 ft in diameter and the inner shell 54 ft in diameter. The space between the shells is filled with cork, the shells being concentric. Nine layers of 4 in. corkboard are applied to the lower half and on these layers the inner sphere rests, the inner sphere being made of stainless steel. The space between the spheres in the upper half is filled with regranulated corkboard. Fig. 2. (Right) An interior view of one of the tanks showing the nine layers of 4 in. corkboard in the process of being installed.

GAS storage capacity usually is a perplexing problem for the operating departments of most natural gas distributing companies. This capacity must be enough to take care of the most severe peak demand that may be experienced at any time so as to be able to meet the safe minimum pressure requirements under any conditions in any part of the distribution system. Quite often the transmission and distribution lines themselves provide this necessary storage capacity, although the usual practice is to supplement the lines with holders, either of the low pressure lift or piston type, or the medium and high pressure spherical types. In any case, the investment in storage capacity usually is a considerable one, whether it involves oversize transmission lines and mains, or conventional holders, or a combination of the two.

The East Ohio Gas Company, of Cleveland, has just attacked this problem in a distinctly new and novel way. This company now liquefies the gas, and then stores the liquid in the three tanks shown herewith.

The liquid has a temperature of 258F below zero. To liquefy the gas is quite a problem in itself, involving considerable chemistry as well as refrigeration engineering. The storing of the liquid is another problem. Liquefaction is performed in several steps in the usual manner in which gases are liquefied, although the process here has certain complications. Natural gas contains moisture and carbon dioxide, both of which liquefy early in this process and are somewhat of a nuisance because when they solidify, as they do, the two together will clog the pipes and stop the process. The moisture and carbon dioxide are therefore carefully removed as soon as possible.

One of the most difficult problems encountered in this whole project was the matter of devising equipment which would hold the liquefied gas safely at 258F below zero. A pilot plant was first built in West Virginia by the Hope Natural Gas Company and it was there that all of the necessary tests were first conducted. Stainless steel was found to be far superior to ordinary steel at exceedingly low temperatures, the ordinary steel becoming excessively brittle. Cork, likewise, was found to be the most suitable insulating material for this unusual purpose. By early 1940 the pilot plant had proved successful and it was then decided to go ahead with the Cleveland plant here described.

The capacity of this newly built and interesting plant is sufficient to liquefy 4 million cu ft of gas per day. This high ratio of storage capacity to the rate at which the gas can be liquefied means a comfortable margin of safety in case of interruptions in the liquefying process, and the ample amount of storage space renders the company relatively free from many of the normally-encountered serious fluctuations in transmission line pressure.—*W. F. Schaphorst.*

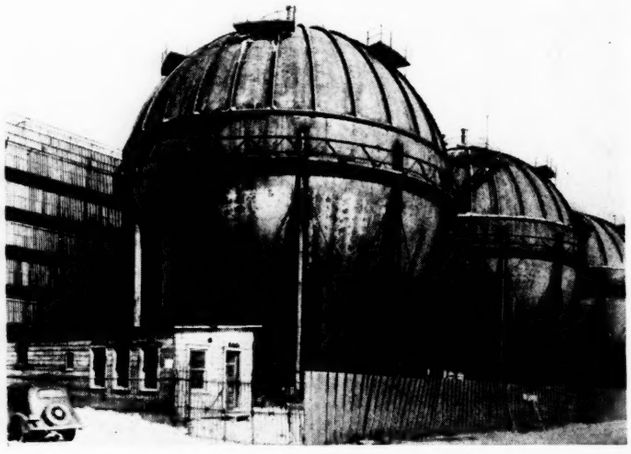
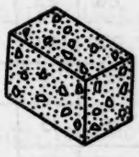


Fig. 3. An outside view of the three completed tanks. Each tank can store 600,000 gal, which is equal to 50 million cu ft of free gas, or a total of 150 million cu ft for the three. To confine this same amount of gas in an ordinary low pressure holder would require a holder 577 ft high by 577 ft in diameter. Side by side these spherical tanks occupy a space of only 200 ft by 60 ft.

HEAT FLOW THROUGH SUNLIT WALLS OF ONE MATERIAL

(This sheet, covering NE, SE, NW and SW walls, supplements Reference Data 175-176 and 177-178, which covered N, E, S and W walls. Explanation appears on those sheets.)

WALLS OF ONE MATERIAL		CONSTRUCTION NO. (ON H. & V.'S REFERENCE DATA SHEET 71 OR 79)	WALL THICKNESS	FACING	HOURS OF DAY: 8 AM	10	12 NOON	2 PM	4	6	8	10	12
					WHEN TEMPERATURE DIFFERENCE GIVEN BELOW IS MULTIPLIED BY THE OVERALL COEFFICIENT, U, THE PRODUCT IS THE ACTUAL RATE OF HEAT FLOW TO INDOOR AIR, IN B.T.U. PER HR. SQ. FT.								
PLAIN BRICK MASONRY WALLS	NO PLASTER ON WALLS	1A	4"	NE	17	20	20	20	20	18	16	13	10
				SE	9	18	23	23	22	21	18	15	11
				SW	2	5	11	24	32	31	27	22	17
				NW	10	9	11	15	20	28	29	25	20
		2A	8"	NE	9	11	12	13	13	14	14	14	13
				SE	6	6	9	13	15	15	15	15	14
				SW	7	6	5	7	13	18	21	20	17
				NW	8	7	6	7	9	13	18	19	18
		3A	12"	NE	10	11	12	13	14	14	13	12	10
				SE	10	11	12	13	14	15	14	12	11
				SW	11	11	11	12	12	12	14	15	14
				NW	11	12	12	13	13	12	12	12	12
STONE WALLS	WALLS ARE WITHOUT PLASTER	9A	8"	NE	8	10	11	12	12	13	14	13	12
				SE	5	6	9	12	14	15	15	14	12
				SW	5	4	5	8	14	19	19	18	16
				NW	6	5	5	7	10	15	18	18	18
		10A	12"	NE	9	9	9	10	10	10	11	12	12
				SE	9	8	7	8	10	11	12	13	13
				SW	9	8	7	8	7	10	14	15	14
				NW	10	8	7	7	7	9	12	14	14
CONCRETE  WALLS	PLAIN WALLS; NO PLASTER		2"	NE	22	23	23	23	21	17	13	8	4
				SE	21	27	27	26	24	20	15	10	5
				SW	5	12	24	33	34	29	23	16	10
				NW	4	9	16	27	33	30	24	18	12
			4"	NE	18	19	20	22	20	18	15	11	7
				SE	13	21	23	25	22	20	16	12	8
				SW	3	8	17	29	31	28	23	18	13
				NW	3	6	12	22	28	29	25	19	14
		13A	8"	NE	11	14	14	15	16	16	15	13	11
				SE	5	10	15	17	18	18	16	14	11
				SW	3	4	8	16	22	24	22	19	15
				NW	12	5	6	11	18	23	23	20	16
			12"	NE	8	9	11	11	12	13	14	13	12
				SE	5	6	9	12	13	14	14	14	13
				SW	6	4	4	7	13	18	19	18	16
				NW	6	5	5	6	9	14	17	18	16
		15A	16"	NE	9	9	9	10	10	11	12	12	12
				SE	8	7	7	9	11	12	13	13	13
				SW	9	7	6	6	8	11	15	15	15
				NW	9	8	7	7	7	9	12	14	15
		16A	20"	NE	10	9	9	9	9	9	10	11	11
				SE	10	9	8	8	9	10	11	11	12
				SW	11	9	8	7	7	8	11	13	13
				NW	11	10	9	8	8	8	9	11	12

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H. & V.'s REFERENCE DATA—225

HEAT FLOW THROUGH SUNLIT WOOD FRAME WALLS

WOOD FRAME WALLS				HOURS OF DAY								
	CONSTRUCTION NO. (ON H. & V.'s REFERENCE DATA SHEET 73 OR 79)	PAINT	FACING	8 AM	10	12 NOON	2 PM	4	6	8	10	12
				WHEN TEMPERATURE DIFFERENCE GIVEN BELOW IS MULTIPLIED BY THE OVERALL COEFFICIENT, U, THE PRODUCT IS THE ACTUAL RATE OF HEAT FLOW TO INDOOR AIR, IN B.T.U. PER HR. SQ. FT.								
WOOD SIDING 25/32" WOOD SHEATHING PLASTER ON STUDDING NO INSULATION	41 B	LIGHT	NE	18	20	21	21	19	17	13	8	4
			SE	18	23	24	24	22	19	14	10	5
			SW	4	11	21	29	30	28	20	15	9
			NW	4	9	15	24	29	27	22	16	10
		DARK	NE	29	29	28	26	23	19	14	9	4
			SE	28	35	34	31	27	22	17	11	5
			SW	5	13	28	41	42	38	27	20	12
			NW	4	9	18	32	40	37	30	22	15
WOOD SIDING 25/32" WOOD SHEATHING PLASTER ON STUDDING ROCK WOOL FILL	41 H	LIGHT	NE	11	15	16	17	18	17	14	11	7
			SE	7	15	18	20	20	18	16	12	8
			SW	1	5	13	22	27	25	21	17	12
			NW	1	4	9	16	24	25	22	18	13
		DARK	NE	20	22	23	22	21	19	16	12	7
			SE	12	23	26	26	24	22	18	14	9
			SW	1	6	17	30	37	33	28	22	15
			NW	1	4	10	20	31	34	29	23	17
WOOD SIDING 25/32" RIGID INSULATION FOR SHEATHING PLASTER ON STUDDING	42 B	LIGHT	NE	17	18	19	20	19	17	13	9	5
			SE	16	21	23	23	22	19	15	10	6
			SW	3	10	19	28	29	26	21	15	10
			NW	3	7	13	23	28	27	22	16	11
		DARK	NE	26	27	26	25	23	19	14	10	5
			SE	25	32	32	30	27	22	17	12	6
			SW	4	12	26	39	40	35	27	20	13
			NW	3	8	16	29	38	37	30	22	15
BRICK VENEER 25/32" WOOD SHEATHING PLASTER	50 B		NE	12	16	17	17	18	17	16	14	12
			SE	6	12	18	20	20	19	18	15	12
			SW	3	4	8	17	26	28	26	22	18
			NW	4	4	6	11	19	26	27	23	19
BRICK VENEER 25/32" WOOD SHEATHING PLASTER ON STUDDING ROCK WOOL FILL	50 H		NE	9	12	14	14	15	15	15	14	13
			SE	5	7	12	16	17	17	16	15	13
			SW	6	4	5	10	18	23	23	21	18
			NW	6	5	5	7	11	18	21	21	18
BRICK VENEER 25/32" RIGID INSULATION FOR SHEATHING PLASTER	51 B		NE	12	16	16	17	17	17	16	15	12
			SE	5	10	16	19	19	19	17	16	13
			SW	4	3	7	15	24	27	25	23	18
			NW	5	4	5	9	16	24	25	23	19

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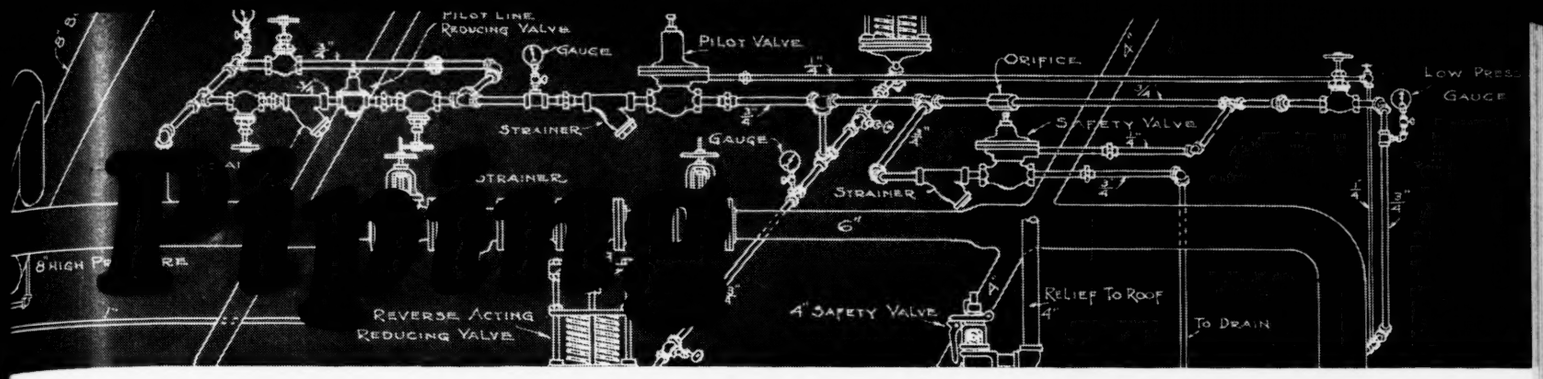


The Welding of Piping—III

By ARTHUR N. KUGLER

Mechanical Engineer, Applied Engineering Dept., Air Reduction Sales Co.

Fittings

In the fabrication and installation of any piping system it is always necessary to change the direction of lines and provide for branch outlets and the reduction from one pipe size to another. To accomplish this, pipe fittings are required. To realize the maximum benefits of welded piping, only those fittings specifically designed for welding should be used. Fortunately, through the years of development of the pipe welding techniques, the fittings industry has kept pace and has provided virtually all the types needed for an efficient and economical piping layout. A typical group of such fittings is illustrated in Fig. 12. It will be observed that all of these fittings are designed for butt welding to the pipe. A butt welded joint produces the most satisfactory results and is, therefore, to be preferred over other types. Fig. 13 illustrates several welding elbows installed in large steam lines in a tunnel. A more recent development for small diameters of pipe is the type illustrated in Fig. 7. This has an advantage in the fact that it is unnecessary to prepare the pipe ends specially for welding, and the assembly is such that it is not critical as to length of pipe insert within the bore, provided it enters the bore with sufficient amount to provide the required bearing.

While it is agreed that welding fittings are to be preferred whenever possible on piping installations, it also should be realized that a competent operator should be capable of fabricating these fittings from standard lengths of pipe when the occasion arises necessitating such action. To facilitate the fabrication of welded fittings, reliable welding supply houses have provided pipe templates which give the lines of intersection of the various elements of the fitting, thus permitting their fabrication by oxyacetylene cutting and fusion welding. It should be stressed at this point that fabrication of fittings should not be attempted unless accurate, proven templates are employed. These templates as supplied are usually master drawings from which the operator, or preferably the drafting room, has traced off the desired pipe intersection curves and transferred them either to heavy building paper, sheet metal or fibre to form the templates which will be used in the field. The use of these master drawings direct on the pipe should be discouraged as a needless waste of valuable material. Fabrication of a typical tee connection by cutting and welding is illustrated in Figs. 14 and 15.

Qualification Tests

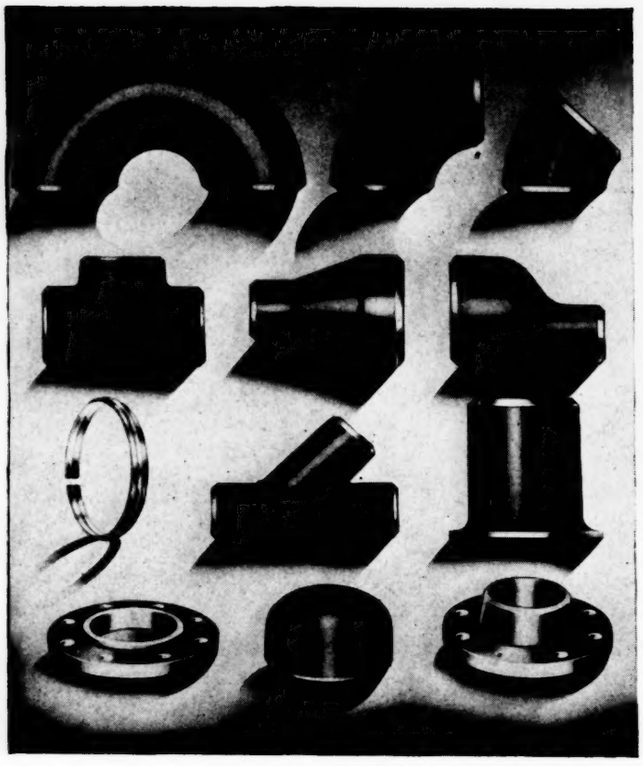
The importance of ascertaining the ability of the welding operators who will weld on a given construction project hardly needs any stressing here. On high pressure and/or high temperature work various state laws together with the regulations of insurance companies make it mandatory that qualification tests be administered for that class of work. By the same token, it is a wise precaution to check the operators who weld on any piping system to make certain that they know their job. It takes but a small leak on a low pressure system to cause damage, the cost of which may far exceed that of applying a simple qualification test. For those jobs where none of the existing codes apply, simple tests have been prepared by the International Acetylene Association in their pamphlet entitled "Rules for the Selection of Operators of Welding Equipment."

At the present moment the several codes applying to welded piping are in a state of flux. The ASME Boiler Code establishes requirements for welded piping which follow very closely the Tentative Standard Qualification Procedure of the American Welding Society. The American Standards Association Code for Pressure Piping, B31.1—1935, is under revision at the present moment. When issued in final form it will doubtless conform to the requirements as established by the ASME and AWS. It should be pointed out that the AWS Tentative Standard Qualification Procedure encompasses more than pipe welding—it covers all forms of process and welding operator qualification tests.

In determining which of the codes apply to a particular pipe welding project, it should be remembered that the ASME Boiler Code governs all piping up to and including the boiler shut off valve. The ASA piping code covers the piping from that point out to the points of ultimate use.

Testing

While the qualification of operators is important from the point of view of determining their fitness to work on the job, it is of even greater importance to test the finished welded pipe system to ascertain whether all welding has been performed as specified and whether it is in safe operating condition. The tests used in qualification procedures are of the destructive type—that is, the qualification welds are tested to de-



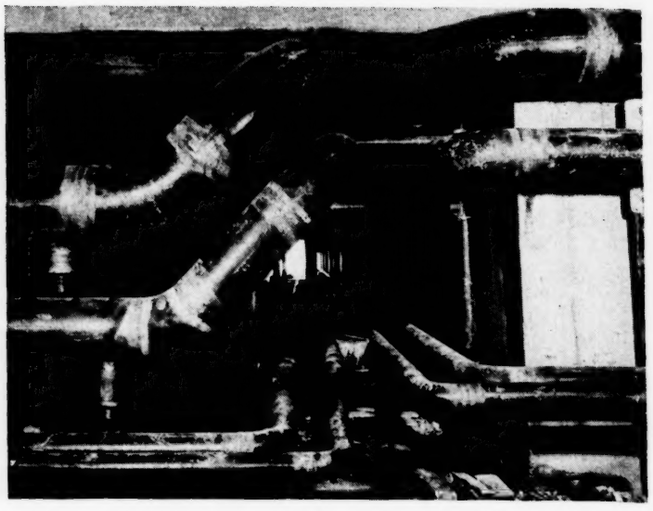


Fig. 12 (left). Group of typical welded fittings. Fig. 13 (above). Assembly of pipe and welded fittings for central heating lines in tunnel.

struction to develop some given physical property. In the testing of a finished system such procedures are not applicable except when a specific weld is questioned, and further, the general use of such practices is excessively costly. Hence, it becomes necessary to employ non-destructive tests to check the finished work. The hydrostatic and X-ray tests are used for this purpose.

It is common practice to test welded lines of low, medium and high pressure classifications by hydrostatic pressure. This is accomplished by filling the line with water, making certain that no air pockets exist. If air should be pocketed at a point of weakness and a fracture ensued then it is quite likely that the metal in the vicinity of the fracture would be shattered by the expansion of the locally compressed air. It is, therefore, vitally important that all entrapped air be removed from the system. Pressure is built up on the water filled line by either hand operated or motor driven pumps capable of developing the required test pressure. Hand operated pumps will suffice on small systems, whereas large systems will require motor driven pumps in order to supply sufficient volume. Frequently, it is required that a system, while under hydrostatic test pressure, be subjected to hammer blows on the pipe adjacent to the weld. These blows should be struck in such a manner as to subject the system to sharp vibratory stresses, but care should be exercised to avoid permanently deforming the pipe metal. The test pressure is generally specified at about 50% in excess of the normal working pressure.

If a piping system is very long and would require too great an amount of water, it sometimes is subjected to an air test at low pressure, say 100 lb per sq in. Under this pressure each welded joint is tested with soapsuds to detect leaks.

For high pressure, high temperature piping, some specifications have required the use of X-ray or gamma ray examination to determine the soundness of the weld. Since it is not generally possible to place the films for these tests at the back of the weld, a method of taking oblique pictures has been developed. At least two pictures are made of each joint to avoid confusion at the points where the images overlap in the oblique technique. X-ray of welded pipe joints is a specialized procedure and one which should be undertaken only by those qualified to operate the equipment and interpret the results.

A destructive test method which has been used extensively for determining the soundness of welded piping systems previously installed or for further checking of joints the quality of which has been questioned on other tests, is that known as trepanning. In this test a plug including portions of the weld metal and base metal is removed from the welded connection. This is accomplished either with a circular saw which leaves a round hole or a special spherical saw which leaves a groove very similar to a single bevel grooved joint. In either case the slug of metal removed is polished and etched along its edges to determine the soundness of penetration and thoroughness of fusion. If such a trepanned plug indicates unsound welding, the weld usually is removed from the line by oxyacetylene cutting and a short piece of pipe welded in its place. If, on the other hand, the weld is found to be satisfactory then the hole left by the trepanning operation usually is filled up with weld metal. In the case of the circular hole, it is sometimes threaded to receive a threaded plug which is then seal welded around the edges.

Non-Ferrous Piping

The method of joining brass and copper piping and tubing is largely determined by the wall thickness. On thin wall tubing the bell and spigot joint in Fig. 6 is probably the simplest to handle. Unfortunately, it has the disadvantage of requiring special preparation and is wasteful of pipe material due to the overlap. However, it is not critical as to fit-up, which is an advantage. Thin wall tubing may be butt welded, gen-

Fig. 14. Oxyacetylene cutting of branch pipe for tee connection.

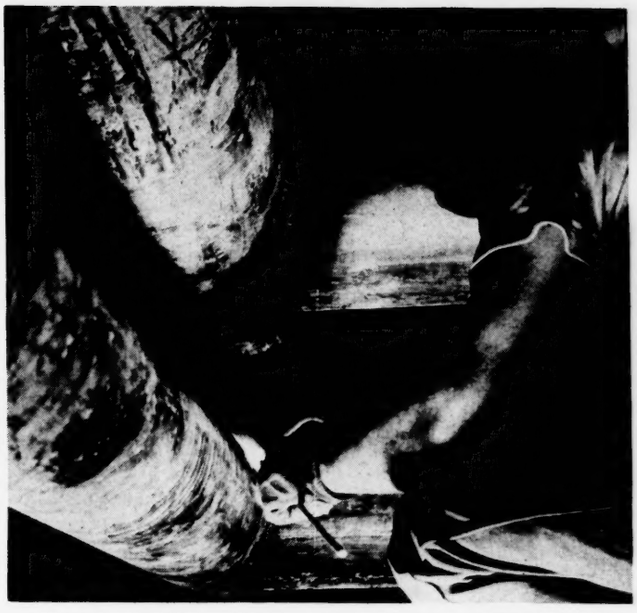


Fig. 15. Welding branch pipe to a main using oxyacetylene.

erally employing the square groove butt joint illustrated in Fig. 1. For heavy wall brass and copper pipe of the same dimensions as iron pipe it is necessary to employ the single vee butt joint shown in Fig. 2.

The filler metals used for welding brass and copper pipe are governed by the class of service to which the pipe will be subjected. In addition, the exact composition of the brass pipe should be ascertained in order to make an intelligent selection of welding rod. For yellow brass pipe (approximately 60% copper—40% zinc) a rod of similar analysis is available and should be used. This rod is the braze welding rod used on other operations. However, since the rod and base metal melt at the same temperature, the joint will not be a braze weld but rather a true fusion weld. If red brass pipe (85% copper—15% zinc) is used then the welding rod may be either the typical braze welding rod[6] mentioned above or a rod of higher copper content[7] which approximates the base metal analysis. The copper-zinc braze welding rod will prove satisfactory on red brass under those conditions where there is no possibility of dezincification due to the fluid carried within the pipe. If the possibility of attack on the zinc content exists then the filler metal should be of higher copper content.

Copper pipe may be braze welded in the true sense of this term. Copper melts at about 1900F, whereas braze welding rods melt at about 1650F. It should be obvious, therefore, that when this filler metal is used on copper, a typical braze weld results. This type of joint is subject to the same limitations as noted above for red brass. When it becomes necessary to duplicate the copper base metal in the weld then a deoxidized copper welding rod should be used. In addition, for fusion welding of copper pipe the base metal should be of the deoxidized copper type in order to obtain high physical properties. Fusion welding of electrolytic or tough pitch copper results in a joint with a weakened zone adjacent to the weld, and failure occurs in this zone at a stress far below normal strength of copper. The braze welding technique can be employed on either electrolytic or deoxidized copper.

In the welding and braze welding of copper and brass pipe the use of a flux is vitally important. The essential function of such a flux is to combine with, or otherwise render harmless, those products of the welding operation which would reduce the physical properties of the deposited metal or make the welding operation difficult or impossible. Most standard fluxes accomplish this result with varying degrees of success. Older standard dry fluxes are subject to the objection that their method of application is too haphazard. The simple operation of dipping the heated rod end into a flux-can and applying it to the welding vee does not provide for uniform distribution of flux. To overcome this there has been recently developed a liquid or semi-paste flux which is painted on the edges of the vee and into which the rod may be dipped. For those who do not wish to dip their own rods the manufacturers have provided flux coated rods, the coating of which is identical with the liquid flux. In addition to the advantage of providing a uniform distribution, this flux also serves to control the volatilization of the zinc content of the braze welding rods. Welds made with this flux on brass and copper pipe will develop satisfactory tensile strengths and will be capable of withstanding the conventional guided bend test.

The joining of tubular non-ferrous sections has been greatly simplified by the development of the slip type fitting in which the necessary low temperature brazing alloy for making the joint is inserted at the time of manufacture. (See Fig. 8.) This type of piping connection is applicable to brass and copper pipe. The fitting is usually of a red brass analysis and the alloy insert consists of about 80% copper, 15% silver and 5% phosphorus. It melts at the low temperature of 1300F. The tubing or piping is cleaned with steel wool

[6]Kugler, A. N.: Oxyacetylene Welding Red Brass Pipe. The Welding Journal, October, 1939, 622-625.

[7]Vreeland, J. J., and J. Babin: Welding and Red Brass. The Welding Journal, April, 1941, 219-225.

or sandpaper for a distance slightly greater than the depth of the seal in the fitting and then fluxed with an appropriate flux. The bore of the fitting is similarly cleaned and fluxed and the pipe inserted in the fitting. Heat is applied first to the pipe, causing it to expand and fit tightly in the fitting. Heating is continued on the pipe until the iridescent colors of the oxide follow the flame around the pipe. The heat is then transferred to the band of the fitting and distributed uniformly around that area. This second heating operation serves to melt the alloy and cause the fitting to expand, permitting the alloy to flow in both directions making the seal. This type of connection will be stronger than either pipe or fitting and may be used at any temperature at which it is safe to use brass or copper pipe. If it is necessary to break the line this may be accomplished by heating the fitting and withdrawing the pipe. These lap seal fittings find extensive use in plumbing, heating and refrigeration installations. Brazing of a typical seal type fitting on hot water lines is illustrated in Fig. 16.

The availability of the foregoing type of brass and copper fittings has been extended to stainless steel tubing and fittings. In this case cast stainless steel fittings are provided with a different type of alloy in a similar groove. This alloy for stainless steel consists of 50% silver, 15.5% copper, 16.5% zinc and 18% cadmium and melts at the exceedingly low temperature of 1175F. By proportioning the lap area in the fitting correctly these joints are made to have a strength equal to or exceeding that of stainless steel tubing.

Aluminum and aluminum alloy piping and tubing finds limited use in industry today. One of the principal applications to date has been for the conveying of fruit juices at extraction plants. In this class of service the piping is of the same nominal dimensions as steel piping, hence the single butt joint is used in the welded connections. Aluminum is available in numerous alloy compositions. The compositions represented by the Aluminum Company of America Nos. 2 and 3 are substantially pure aluminum and are generally welded with a welding rod of pure aluminum analysis, namely 2S.

Organization of a Welded Pipe Job

The successful prosecution and economical operation of a welded pipe job requires careful planning. It has been pointed out previously that welding in a flat or downhand position produces welds of the highest quality and at the same time fastest speed and therefore, lowest cost. From this it may be reasoned that the greater the proportion of rolling welds that may be made on a given welding job the lower the cost on that job. It should be obvious that welding performed in the shop can generally be performed in the flat position as rolling welds. In addition, a well equipped shop will provide the necessary jigs and equipment to handle large sections of pipe and rotate them as rolling welds. Therefore in the organization of a pipe welding job, as much of the work as conditions will permit should be fabricated in the shop. If the shop is some distance from the site of the job, transportation facilities may limit the maximum size of assembly which can be handled economically. On the other hand, if a job is large enough it may be expedient to erect a fabrication shop at the site of the job in order to gain the greatest benefit from this method of assembly. The work fabricated in the shop may also be pretested by submitting the fabricated sections to a hydrostatic test before shipment. This will eliminate long costly repairs in the field where conditions are not ideal. If a contractor does not have shop facilities available there are firms located at convenient points throughout the country who will be glad to undertake shop fabrication of piping, thus rendering these advantages available under almost any circumstance.

Welding of pipe in the field inevitably means working under very unfavorable conditions. By far the greatest proportion of the welds will be in fixed positions and, in addition, all manner of obstructions will add further difficulties. Obviously only the most competent operators should be permitted to weld under these difficult conditions. Present qualification tests are designed for just that purpose in that the operators must weld their test pieces in the fixed positions.

An operator in the field should be provided with all possible facilities to make his work as easy as possible. Stagings, ladders, or other substantial supports should be provided. It is asking too much to expect an operator to make a weld in a difficult position and at the same time stand on some flimsy, insecure support.

Conditions on construction work are not always the best. Lumber from packing cases, scaffolding and other debris are usually scattered all about. The welding operator and the superintendent in charge of the job should exercise every precaution to avoid fires resulting from the sparks of welding and cutting. There has been sufficient recent evidence of the results of such carelessness in this direction to emphasize the importance of this precaution!

Cost Estimating

Direct welding costs are made up of two factors; first, labor, and second, material. In the welding industry it has become a practice to develop costs on a "per joint" basis. The piping industry, on the other hand, has for a number of years based their cost estimating on the "diameter inch." It is therefore necessary to relate these two units one to the other. The term "diameter inch" is used to provide a common denominator in calculating the amount and cost of work to be performed on pipe systems involving a number of different sizes of pipe. It may be defined as one inch of nominal pipe diameter. Thus a 2 in. pipe is 2 diameter inches and an 8 in. pipe is 8 diameter inches, etc. A production of 45 diameter inches per day therefore can mean ten 4½ in. joints or seven 6 in. joints and one 3 in. joint or three 10 in. joints and five 3 in. joints. Therefore the cost of a welded joint may be divided by the number of diameter inches to arrive at the cost per diameter inch.

In actual practice on pipe installations, however, it is no longer necessary to calculate the cost on each individual size of pipe. Experience has shown that

certain quantities of material are required by a welding crew for one day's work, during which time they will produce, within a certain range, a given amount of work. In Table 3 are shown the quantities of oxygen, acetylene and welding rods consumed by a welding crew in an average 8-hour day:

TABLE 3.—MATERIAL USED BY WELDING CREW IN 8-HR. DAY

Material	Standard Weight Pipe	Extra Heavy Weight Pipe
Oxygen	200-300 cu ft	300-400 cu ft
Acetylene	200-300 cu ft	300-400 cu ft
Rods	20-30 lb	30-40 lb

These figures include a small amount of cutting incidental to the usual pipe welding operations. They do not include, however, extensive cutting and fitting of pipe on the job.

The actual production of diameter inches of welding per day varies with different types of jobs and in different locations. We can only quote reasonable ranges of production here and suggest to those using these figures that they check locally to determine what the average production rate is. For standard weight pipe the production ranges from 40 to 100 diameter inches per 8-hour day throughout the country. This is, of course, an extreme variation and the actual variation on a well organized job would range more likely between 50 and 80 diameter inches per day. Similarly, production figures on extra heavy pipe show an extreme variation of 30 to 75 diameter inches per day while average conditions indicate production of the order of 35 to 65 diameter inches per day.

Using these data, let us estimate a typical cost per diameter inch for welding standard weight pipe.

Material		
Oxygen .....220 cu ft @ $1.50 per 100 cu ft	$3.30	
Acetylene .....220 cu ft @ 3.00 per 100 cu ft	6.60	
Airco No. 1 rods 25 lb, 20c per lb	5.00	
Material cost per 8-hr day....	$14.90	$14.90
Labor		
1 Steamfitter welder 8 hours @ $1.25 per hr.	$10.00	
1 Helper 8 hours @ 50c per hr	4.00	
Labor cost per 8-hr day	$14.00	$14.00
Total cost of labor and material		$28.90

The foregoing figures for labor and material are purely arbitrary and do not necessarily represent actual costs as they exist today. They are used merely for the purpose of illustration. To determine the cost per diameter inch from the above cost for the welding crew it is merely necessary to divide the total labor and material figure by the production per day (here taken at 60 diameter inches) as illustrated below:—

$$\$28.90 \div 60 = \$0.482$$

The cost for welding extra heavy pipe would be established in a similar manner using the appropriate figures. If it is necessary to do any large amount of fabrication on fittings these may be calculated in the same manner, making due allowance for the extra cutting and welding involved.

The estimating of costs for arc welding pipe have not been developed to the same degree as have those for gas welding. However, the basic principles are the same and the allowance for labor would be exactly as outlined above. The allowance for material would involve two items namely, electric power and welding electrodes. The cost of gasoline or power consumed would be dependent upon the size of the welding machine employed, the work factor and the local prevailing rates for gasoline or electric current. The material costs would be influenced first by whether or not chill rings would be employed; second the size and type of electrodes used and the number of passes; third the sizes of the individual passes. If chill rings are not used a different technique is required and in general slower speeds result. For those who have to prepare estimates a figure of 1½ to 2 lb of electrodes per hour may be used as a rough figure.

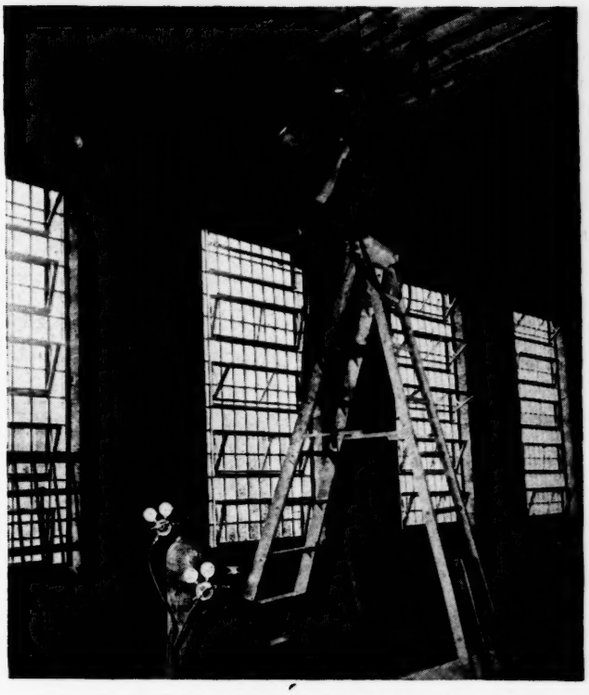


Fig. 16. Making joint on seal-type fitting in red brass hot water lines.

From the foregoing it will be seen that the many variables possible in arc welding piping render it difficult to establish a procedure similar to that given for oxyacetylene welding. For the same reasons it is not possible to give definite figures for production.

Conclusion

The welding of piping for all classes of service has long since passed the experimental stage; it is no longer a substitute process—rather it is the standard by which all other methods are judged. When the present war emergency has passed the writer believes that we shall see virtually all pipe welded, first, because it is the best method and, second, because we shall have an abundance of fully competent operators.

Acknowledgment

The author wishes to acknowledge gratefully the assistance rendered by Tube Turns, Inc., Louisville, Kentucky and John W. Danforth Company, Buffalo, N. Y. in securing many of the photographs used in this article.

REVIEWS

POULTRY HOUSE VENTILATION

"The Ventilation of Poultry Laying Houses", by F. L. Fairbanks and A. M. Goodman, Office of Publication, Robert Hall, College of Agriculture, Ithaca, N. Y. Upon Request.

A recently revised edition of this Cornell Extension Bulletin No. 315, published by the New York State College of Agriculture at Cornell University, presents the original work up-to-date. The authors discuss the latest approved methods of ventilating poultry houses, pointing out the requirements of the two general classes into which they divide their subject. These are the cold-house type and the warm-house type respectively.

Cold-house temperatures, being only a little above outside temperatures, are below freezing much of the time in winter and this tends to make this type more difficult to ventilate by gravity ventilation, than the other. The warm-house type has temperatures approximately 10 to 25F above outside temperatures.

A detailed discussion of the outtakes and intakes, outlet flues, ventilator heads, and built-in inlets is given.

A page is also devoted to the discussion of the use of electric fans in this work. This includes a table of fan sizes with approximate current consumption per month for various sizes of houses.

This is a 28-page, 6 x 9 in. paper covered bulletin.

SUN RADIATION

"Annals of the Astrophysical Observatory of the Smithsonian Institution, Volume 6," by C. G. Abbot, L. B. Aldrich and W. H. Hoover. Price $2.65.

This unique series of observations, which is duplicated by no other observatory in the world, represents half a lifetime of observing the sun's radiation. The tables show how this radiation, upon which all weather and life depends, has varied from day to day and from month to month in the last twenty years. The observations and the calculations based upon them were the work of the Smithsonian Institution, who also did the publishing.

Many ingenious devices were used in gathering the data, among them an electrical thermometer capable of detecting a millionth of a degree rise in temperature. The observations were made in deep tunnels hewn in the tops of high desert mountains in order to secure constant temperatures. Fifteen thousand measurements were made at 9000 ft elevation on Mount Montezuma, Chile, where less than an inch of rain falls in 20 years and the only sign of life was the common housefly. On Table Mountain of the Mojave Desert, California, 10,000 measurements were made, while 4000 were taken on Mount Katherine which overlooks Mount Sinai where Moses is said to have received the Ten Commandments.

Dr. Abbot's calculations show that the heat of the sun varies from month to month according to a complex inter-weaving of 14 cycles. The combination results in such a seemingly irregular variation that detecting the cycles at all is difficult. Efforts are being made to connect these variations in radiation with the weather but at this time no very definite conclusions have been drawn.

Air conditioning engineers will be interested in this study because of its relation to the subject of heat gains through building walls. This information on the variation in the intensity of the sun's radiation should be directly applicable when calculations are made in which incident angles are used in figuring sun effect on walls and roofs.

VENTILATION

"Ventilation and Atmospheric Pollution." Published by the American Public Health Association, 1790 Broadway, New York, N. Y.

This five-page, 7 x 10 pamphlet is the fourth report of a subcommittee on bacteriologic procedures in air analysis. The report cites advances in three fields of activity in which the committee was engaged: (1) Through the use of a suitable selective medium comparable to those used in isolating coliform organisms from drinking water, a method is now available to confirm presumptive tests described in the committee's report of the previous year. As a result the whole technique of estimating atmospheric pollution becomes analogous to that of estimating water pollution. (2) A study of the settling of particles atomized into a closed chamber has resulted in possession of a theoretical basis for empirical tests of state of suspension suggested in previous reports. (3) A study of the method of measuring sanitary ventilation has resulted in considerable data being available for practical use in ventilation investigations.

This paper is reprinted from Year Book, 1942, Supplement to American Journal of Public Health, Vol. 32, No. 3, March 1942.

DOMESTIC OIL HEATING

"Twenty Years of Progress in Domestic Oil Heating," by Rene J. Bender. Published by the American Society of Mechanical Engineers, 29 West 39th St., New York, N. Y.

This paper, contributed by the Fuels Division of the ASME for presentation at the semi-annual meeting at Cleveland gives an interesting history of oil burning appliances. Starting with the "Astrakan" stove, which was found in Russia as early as 1860 and which the author refers to as the ancestor of oil burning appliances, the various types of appliances are traced down through the years to the present day.

In mentioning increasing efficiency as one of the leading causes for the growth in popularity of domestic oil burners, the author brings out two points which will interest the heating engineer: (1) he found that in actual field testing of 500 existing domestic installations the average CO_2 content was 8.72%, with average flue gas temperature of 553F. After field adjustments the CO_2 content rose to 9.16% and the flue gas temperature dropped to 503F. (2) Again based on a large number of field tests, he found that combustion efficiency is greatly dependent upon the percentage of time which the burner operates. In other words, a boiler designed to operate 100% of the time on the coldest day in winter will, when operating at 20 to 30% of the time in average winter weather, have an efficiency about 10% less than its efficiency when operating at 100% of the time. This is shown graphically on a chart which gives efficiencies for operating load factors between 0 and 100%.

The author devotes the last page of this 8½ x 11 inch, 10-page paper to a discussion of burner adjustments and their effect on operation.

FUEL CONSERVATION

"Saving Fuel for Heating," by J. F. Collins, Jr. Published by The Industrial Press, 148 Lafayette St., New York, from Heating and Ventilating, June, 1942. Price, 25 cents.

A sixteen-page pamphlet, 9 x 12 in., printed in blue and summarizing practical information on fuel conservation. The pamphlet, which constitutes HEATING AND VENTILATING's Reference Section No. 5, consists of six parts: Records and Data; Heat Loss Survey; Building Structure Survey; System and Control Study; Making the Improvements and Operating to Save Heat.

SHEET METAL LAYOUT

"Sheet-Metal Pattern Drafting," F. J. O'Rourke. McGraw-Hill Book Co., Inc., New York, N. Y. $2.

This book is intended by the author to act as an instructive guide for such skilled sheet metal workers who have a desire to keep up with new developments. The intent is not to make an expert pattern draftsman out of every sheet metal mechanic but to provide such mechanics with a proficiency which will be useful in the interpretation of difficult drawings and templates that are sent to them to be constructed.

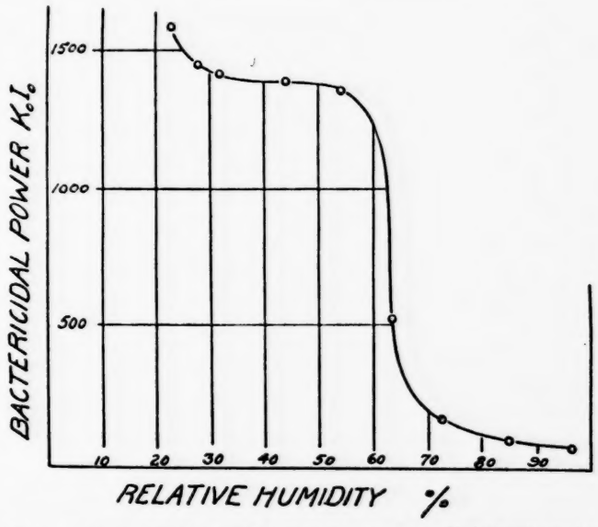
Practical shop problems in sheet metal drafting of the kind that appear in everyday practice are included in the discussion.

AIR STERILIZATION

"Radiant Disinfection of Air," by W. F. Wells, Reprinted from the Archives of Physical Therapy, March 1942, Vol. XXIII, pp. 143-148.

In this five-page, 7 x 10 leaflet, the author, who is Associate Professor of Research in Air-Borne Infection, Department of Public Health and Preventive Medicine, University of Pennsylvania School of Medicine, discusses and defines, briefly but comprehensively, various factors considered in the disinfection of air by radiation.

These factors are listed under the following paragraph headings: Equivalent Ventilation; Bactericidal Radiation; Humidity; Lethal Exposure; Uniform Lethal Intensity in Space; Uniformity Factor; Radiant Distance; Reflectors; Variable Intensity in Space; Recirculation; Circulation; Sanitary Ventilation; Barriers, and Radiant Disinfection.



Curve from Prof. Wells' paper on air disinfection by radiation showing the effect of relative humidity on the bactericidal power of ultraviolet radiation.

One odd effect brought to light is the effect of humidity on the bactericidal effectiveness of ultraviolet light. This radiation is much more effective under low humidity conditions than under high. Furthermore, there is a very sudden change in this germicidal power within the humidity range of 50 to 75%, the killing power dropping off 90% as the humidity rises through this range.

This paper was presented before the American Congress of Physical Therapy, Washington, D. C.

NEWS OF THE MONTH

Bituminous Coal Research, Inc., Develops Stokers, Space Heaters

COLUMBUS, OHIO—Improved equipment for the utilization of bituminous coal for comfort heating and other applications is foreseen by fuel engineers who addressed 140 representatives of the bituminous coal industry May 28, at Battelle Memorial Institute here.

The occasion was an all-day conference and exhibit on bituminous coal research and was sponsored by Bituminous Coal Research, Inc., the research agency of the bituminous coal industry.

Smokeless space heaters and service water heaters, completely automatic residential stokers, and other new developments which will increase the markets for coal were demonstrated and discussed.

The streamlined coal-burning space heater attracted considerable attention because of its modern appearance, smokeless operation, magazine feeding, and automatic control. The smokeless principle, developed under the joint sponsorship of the coal industry and 29 large stove manufacturing companies, has been adapted to a room heater, to a heater with separate heat exchanger, and to a service water heater.

According to Howard R. Limbacher, who has been associated with the development, over 40% of the urban homes of the country are heated by stoves, and normally about one million are sold annually.

The first step in the program, according to Mr. Limbacher, was the study of a conventional space heater to establish a yardstick by which the performance of other heaters could be evaluated. Improved heaters were then investigated.

The problem of designing a completely automatic stoker for residential heating has no unique solution, stated R. A. Sherman, who disclosed that a stoker which incorporates a revolving burner head in the center of an underfeed retort has been developed in the Battelle laboratories.

William B. Ramsdale discussed the merits of a second type of residential stoker, which will handle difficult coals with automatic removal of the ash. Both units were demonstrated in the laboratories.

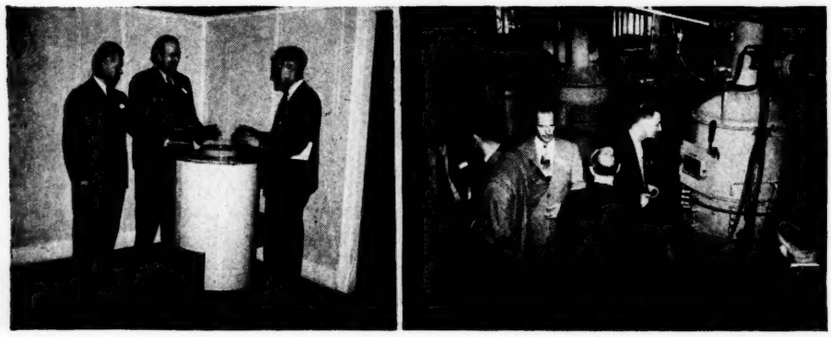
Conversion of Plants to War Work Surveyed by Boiler Group

NEW YORK—Designed to speed up the conversion of the plants of boiler and radiator manufacturers for the production of essential war materials, a survey of the manufacturing facilities of members of The Institute of Boiler and Radiator Manufacturers was completed recently.

Nearly 1500 copies of the survey entitled Facilities for War Production have been sent to WPB, including district and local offices, government agencies, and prime contractors.

The survey is the most comprehensive ever made of the manufacturing facilities of the boiler and radiator industry. Detailed information is set forth on the number of employes at each plant, total floor area, number of cupolas, capacity of cranes, types of moulding, average and maximum weight of castings, and other facilities.

The booklet of 36 pages is illustrated with 26 pictures of manufacturing processes which are of the greatest interest to the WPB and prime contractors. Copies of the booklet may be obtained by addressing the general manager of The Institute of Boiler and Radiator Manufacturers, R. E. Ferry, 60 East 42nd St., New York City.



AT THE BITUMINOUS COAL RESEARCH CONFERENCE IN COLUMBUS

(Left) Heat without smoke issues from the new magazine stove developed at Battelle. (Right) E. S. Pugh, president of Lillybrook Coal Company, watches the B.C.R. stoker perform on a strongly-coking coal.

J. M. Fernald Addresses ASRE; Explains WPB AC Set-Up

SKYTOP, PA.—A paper on blood plasma preservation and an address by J. M. Fernald, Chief of the Air Conditioning and Commercial Refrigeration Branch of WPB, were features of the spring meeting of the American Society of Refrigerating Engineers held here June 7-9.

Mr. Fernald explained the set-up of his branch and said that it consisted of five commodity sections —Air Conditioning; Commercial and Industrial; Refrigerator; Heat Exchanger; and Accessories. In addition there are four staff sections serving all commodity sections and consisting of the Conversion Section, formed to bring about maximum use of existing industrial capacity within the industry for the production of war material and products for essential civilian use; the Conservation Section, which effects, with the assistance of the Bureau of Industrial Conservation, the Materials Division and the design engineers of the industry, maximum saving of material, labor, and production facilities required for the production of all essential commodities produced by the industry; the Priorities Section which essentially analyzes and processes all applications for Preference Ratings on PD-1A's, Production Requirement Plan. At the present time this Section is processing approximately 1000 PD-1A's per week, and within the next two months will be handling in excess of 500 Production Requirement Plan applications, in view of the fact that the new Limitation Order actually forces producers to the use of this plan; and the Planning and Requirements Section which is essentially a clearance section for all data, statistics, reports, etc., the administration of orders and in general, correlates all activities of the Branch to avoid duplication and confliction within the Branch.

In order to coordinate their efforts more closely with all other Divisions and Bureaus a specialist is assigned to the Branch from each of the principal Divisions and Bureaus of the War Production Board.

Knighton Heads Victory Program

NEW YORK — John K. Knighton, Evansville, Ind., has been named national director of the Program for Victory of the Refrigeration Industry. His address will be Victory Program, 119 North Morton St., Evansville, Ind.

A.C. Standards Are Amended

ATLANTIC CITY—Amendments to standards for the installation of air conditioning equipment were adopted May 12 by the National Fire Protection Association upon presentation of a report by the Committee on Air Conditioning, prepared under the direction of its chairman, F. H. Faust, General Electric Co.

Specifications for the thickness of metal for air ducts were enlarged to include approved types of joint connections and bracing.

A measure of safety in the rating of fusible links for automatic fire doors and dampers was adopted by setting the rating at 50% higher than the maximum temperatures to be encountered in any air conditioning system.

An exception was granted to the rule requiring smoke dampers in the main supply and main return ducts of systems of more than 15,000 cfm capacity when the system is located on the same floor it serves.

Formerly, all electric lamps enclosed in an air conditioning system were required to be of the marine or vaportight type, but a new amendment makes it possible to use germicidal lamps having no filament and of low exposed surface temperatures.

The use of No. 18 U. S. gauge metal for louvered type dampers was specified.

ASHVE Suggests Fuel Survey

NEW YORK — On June 25 the War Service Committee of the ASHVE delivered its findings and recommendations to Secretary of the Interior Harold L. Ickes.

In response to the offer of the Society to make its research and other facilities available to the government, Secretary Ickes requested the Society's cooperation in finding a solution for the current fuel supply problem.

The committee made it plain that current surveys must accurately determine the amount of coal and oil that is expected to be available in the critical areas and offered four specific methods, which could be progressively applied to meet even the most drastic fuel conservation program, and suggested specific methods to inform the public promptly concerning economic and speedy methods of adapting or installing accessory equipment to meet the existing emergency.

Members of the War Service Committee who presented the report are chairman, B. M. Woods, Professor of Mechanical Engineering, University of California, and W. L. Fleisher, consulting engineer, New York.

Will Study Heat Flow in Walls

NEW YORK—Dean J. W. Barker of the School of Engineering, Columbia University, and F. C. McIntosh, Pittsburgh, chairman of the ASHVE committee on research, have consummated a cooperative agreement to investigate heat flow through various building walls.

The research program will be carried on in the heat transfer laboratory at the University by means of a specially designed apparatus for transient heat flow, in accordance with a study jointly planned by Dr. F. C. Houghten, director of the ASHVE laboratory, Pittsburgh, and Dr. Victor Paschkis, research associate at the University. The latter will conduct the laboratory work.

From the results of this research it is predicted that the engineer will have additional data available for analyzing more accurately the cooling requirements of an air conditioned building.

Boston Chapter Elects Carrier

BOSTON—At the June meeting of the Massachusetts chapter, ASHVE, Earl W. Carrier was elected president; Fred C. Ellis, vice-president, and Ray Kern, secretary-treasurer. Committee chairmen are as follows: meetings and papers, G. B. Gerrish; membership, Fred Ellis; social, R. L. Lincoln. Fred D. B. Ingalls was elected to life membership in the chapter. He also was recently elected a life member of the national organization.

A.C. Bureau Honors Johnson

BOSTON—Members of the Air Conditioning Bureau on June 24 paid tribute to their president of the previous year, E. Daniel Johnson, at the annual Past Presidents' Night. Mr. Johnson, who represents the Buffalo Forge Company, was presented with a desk set, following the dinner. Forrest Paige, this year's president, presided.

Charles P. Monash

CHICAGO — Charles P. Monash, 80 years of age, president of the Monash-Younker Company for 52 years, died here May 30 after an illness of several years.

Born in Plattsburg, N. Y., Mr. Monash was associated for years as secretary with the Van Auken Steam Specialty Co., which he later took over, and in 1889 organized the Monash-Younker Company.

Mr. Monash was very active in the steam specialty line up to a few years ago when he retired on account of illness.

J. Irvine Lyle

SYRACUSE—J. Irvine Lyle, president of Carrier Corporation, and one of its founders, died here June 7 after an illness of three months.

In 1902 Mr. Lyle collaborated with Dr. Willis H. Carrier in developing air conditioning. Some years later Mr. Lyle, along with Dr. Carrier and other associates, organized Carrier Engineering Corporation, the first company to devote itself exclusively to the air conditioning business. Mr. Lyle served as general manager and treasurer of this concern, which in 1930 became Carrier Corporation. Mr. Lyle was also president of Aerofin Corporation and a director of Auditorium Conditioning Corporation.

In addition to participating in the development of the world's leading air conditioning company, Mr. Lyle's interests were wide and varied. He was a past president of the ASHVE and of the Refrigeration Machinery Association. He was a member of the ASRE. During World War I he served as a member of the Advisory Committee of the National Council of Defense. In Syracuse, Mr. Lyle was active in civic affairs, his particular interests being the Salvation Army and the Syracuse Chamber of Commerce of which he was a member of the board of directors.

Mr. Lyle is survived by his widow, a daughter, a son, and two brothers, C. R. Lyle of Washington, D. C., and E. T. Lyle of Orlando, Florida.

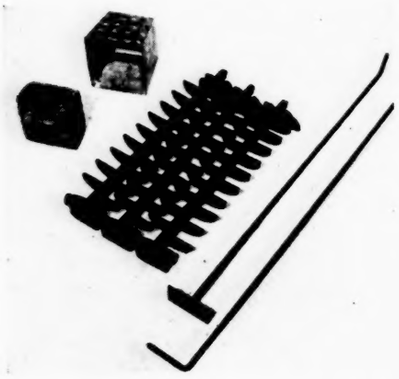
Charles L. Meyer

NEW YORK—Charles L. Meyer, mechanical and sales engineer with the L. J. Wing Mfg. Co. for the past 18 years, died suddenly June 26, at his home in Hollis, L. I.

Mr. Meyer, 53, was born in New York City and attended Pratt Institute and Brooklyn Polytechnic College. His first position was with the Brooklyn Edison Co., as engineering assistant, which he held from 1908 to 1910. With Westinghouse, Church, Kerr and Co., he worked on power plant layouts, and in heating and ventilating. From 1915 to 1921 he was engaged in the development, design, and maintenance of manufacturing equipment, power plant and buildings, for National Aniline and Chemical Co., manufacturer of dyestuffs and chemicals.

In 1922 he became associated with the Alexander Hamilton Institute, New York, and in 1924 he became sales engineer in charge of sales in the Metropolitan district for L. J. Wing Mfg. Co.

NEW EQUIPMENT



Coal Grate for Oil Boiler

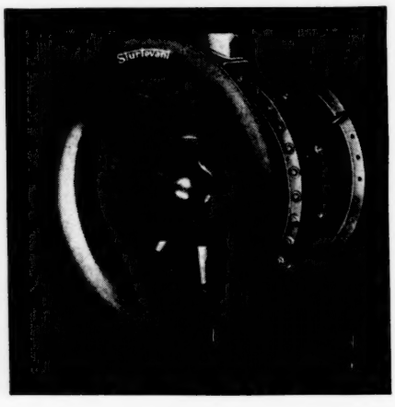
NAME—Convert-O-Grate.
PURPOSE — For adapting heating boilers to either coal or oil firing without extensive changes in installation.
FEATURES—This appliance consists of a series of grate bars mounted on bearing blocks across the top of the combustion chamber. It is applied to boilers already equipped with gun-type oil burners. Oil burner remains in place and its fan is used to provide air for combustion of the coal. All automatic features of the oil-burning set-up are retained, hand-firing and ash removal being the only manual tasks necessary when coal is used. Manufacturer states that preliminary installation of bearing blocks and ash removal port requires about two hours time, while subsequent changes from one fuel to another take about 8 minues. Owner is thus enabled to use whichever fuel is available.
MADE BY—*Anchor Post Fence Co., Baltimore, Md.*

Liquid Soldering Flux

NAME—Special-X Industrial Concentrate.
PURPOSE—To be used as a flux in welding stainless steel, monel metal, copper alloys, brasses, iron, zinc, and most other metals and alloys except aluminum.
FEATURES—This product is said to be an extremely powerful flux but so mild that it will not injure the hands or clothing. Sold as a concentrate, but can be used at either full strength or diluted to suit the job. It is said to be used extensively in war production in fabrication of such items as divers' helmets, submarine controls, machine gun parts, motor controls, and others.
MADE BY—*Industrial Service Laboratories, 7656 W. Forest Home Avenue, Milwaukee, Wis.*

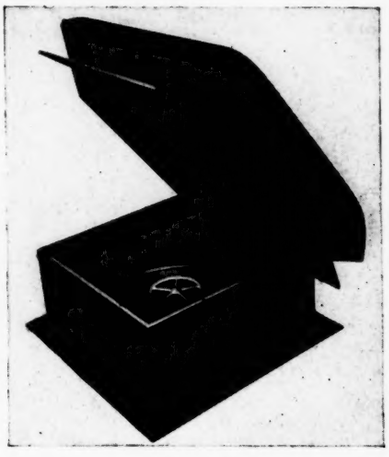
Axial Flow Fan

NAME—Victory Axiflo Fans.
PURPOSE—For heating, ventilating and mechanical draft service. Present use restricted entirely to U. S. Navy work. Available for general industry after the war.
FEATURES—Consists of a multi-blade wheel direct-connected to an enclosed motor which is mounted in a spoke assembly in the housing, the spokes serving as air flow straighteners. The distinctive features claimed for this fan are: (1) mechanical efficiency over 90%. (2) Quiet operation (12,000 cfm unit produces 80 decibels at 3 in. SP). (3) Compactness, light weight, and small size. (4) High rotative speeds with motor driven units turning at 1160 to 1750 rpm and turbine driven units at speeds up to 5000 rpm.
SIZES AND CAPACITIES—Made in pressure ranges from ½ in. to 6 in. water column in the motor driven types; 60 in. water column for turbine driven. Wide ranges of sizes and volumes.
MADE BY—*B. F. Sturtevant Co., Hyde Park, Mass.*



Lead Coated Sheets

NAME — Continental Lead-Sealed sheets.
PURPOSE — For sheet metal work, furnace housings, ductwork and in general wherever galvanized sheets would be used.
FEATURES—These sheets are lead coated by a new process said to give a softer and more ductile sheet with a coating which will not fracture or peel in forming operations. Increased ductility is explained by the fact that the coating reaction with the base metal does not stiffen the latter. It is claimed that sheets solder easily without flux or acid and that the lead coating serves as a lubricant in die forming.
MADE BY — *Continental Steel Corporation, Kokomo, Indiana.*

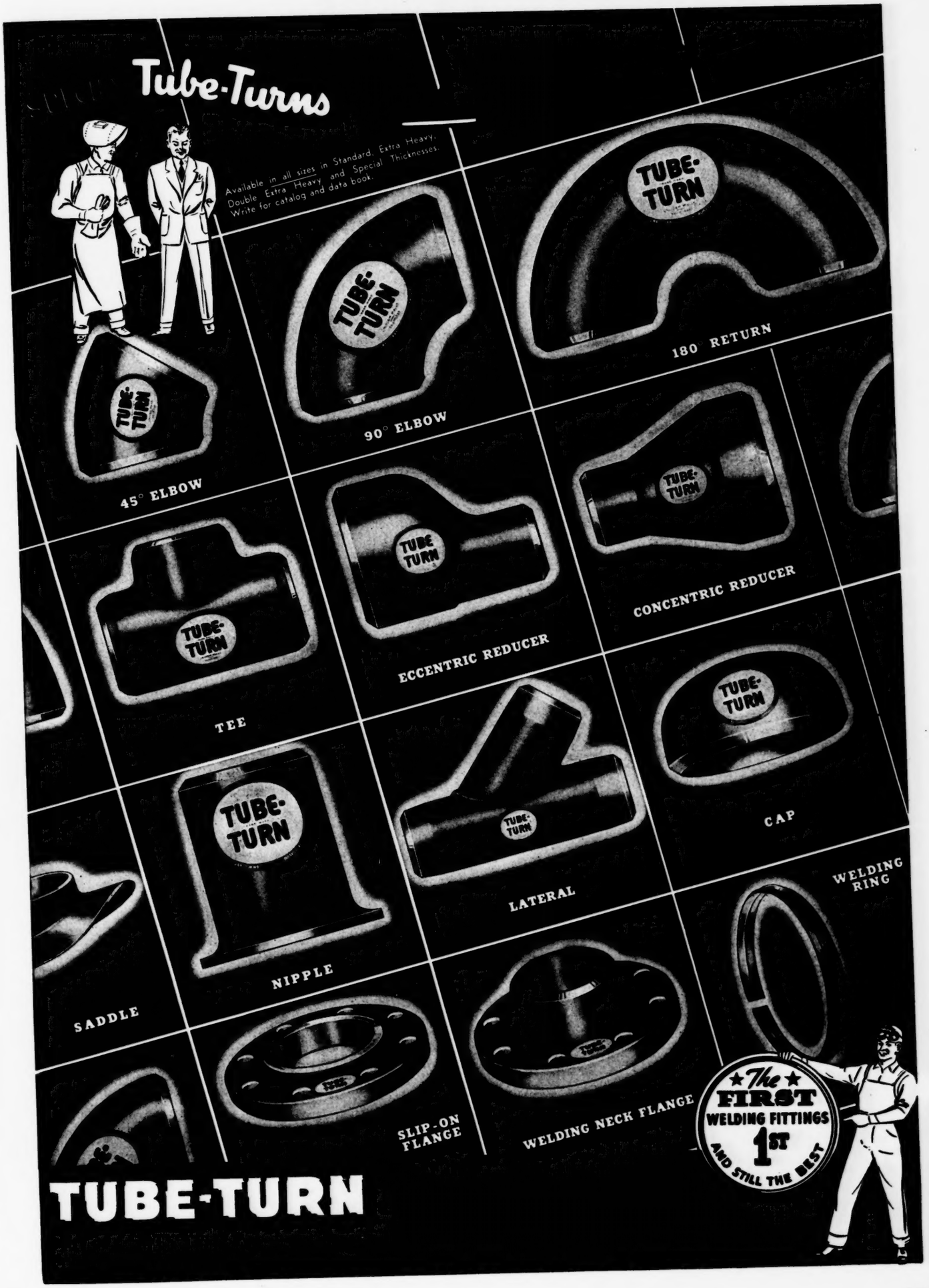


Blackout Roof Ventilator

NAME — Allen type "H" roof ventilator.
PURPOSE — For ventilating buildings under blackout conditions.
FEATURES — This is an integrally built roof fan installed over an opening in the roof the same size as the fan housing. Has a multiple blade fan wheel electrically driven through a V-belt. The hood is equipped with counter-balanced dampers which open and close automatically as the motor is turned on or off, thus providing controlled ventilation. The hood lifts vertically upon removing two end bolts, the other two bolts acting as hinges, this giving easy access to internal portions. Installations can be made on roofs with angles up to 45 degrees. Horsepower requirements claimed to be very small in proportion to volume of air moved.
SIZES AND CAPACITIES — Available in fan diameters from 30 to 60 in. with a capacity range of 5600 to 45,000 cfm.
MADE BY — *The Allen Corporation, 9751 Erwin Avenue, Detroit, Mich.*

Cement for Concrete Patching

NAME — Smooth-On No. 7B Quick Patch cement.
PURPOSE — For quick patching of cracks, ruts, and shallow holes in concrete floors.
FEATURES — Cement is said to be extremely wear resistant as well as dust-proof, oil-proof, and water-proof. Will harden overnight, permitting full traffic next morning. Strength increases with age. Adheres firmly to the surfaces with which it comes in contact.
MADE BY — *Smooth-On Mfg. Co., Dept. 364, 570 Communipaw Ave., Jersey City, N. J.*


Tube-Turns
Available in all sizes in Standard, Extra Heavy, Double Extra Heavy and Special Thicknesses. Write for catalog and data book.
45° ELBOW
90° ELBOW
180° RETURN
TEE
ECCENTRIC REDUCER
CONCENTRIC REDUCER
SADDLE
NIPPLE
LATERAL
CAP
WELDING RING
SLIP-ON FLANGE
WELDING NECK FLANGE
The FIRST WELDING FITTINGS 1ST AND STILL THE BEST
TUBE-TURN

Wartime Unit Heater

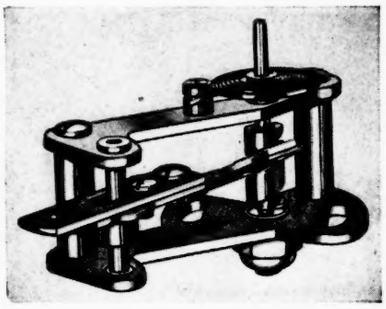
NAME — The Victory line of unit heaters.
PURPOSE—For standard unit heater applications, to conserve critical materials.
FEATURES—These are all-steel units with tubes welded to the headers. Steel fins are attached to the steel tubes by a method which maintains mechanical pressure on adjoining fins, thus providing good contact. Header tubes and all parts which come in contact with steam and condensate are said to be approximately the same thickness as standard steel pipes. The units come in two general types: a propeller fan type with horizontal discharge and a blower type with vertical downward discharge.
SIZES AND CAPACITIES — Blower type in sizes from 65 to 2000 sq ft EDR and centrifugal blower type in small cabinet models and large industrial types from 75 to 4000 sq ft EDR.
MADE BY—*C. A. Dunham Company, 450 E. Ohio Street, Chicago, Ill.*

Foamglas

NAME—Armstrong's Foamglas.
PURPOSE—For low temperature insulation.
FEATURES — This porous, cellular type of glass is made by firing ordinary glass which has been mixed with a small quantity of carbon, resulting in gasification of the carbon and formation of a rigid sponge-like structure. It is claimed to be only about 1/15 as heavy as the original glass. This product is said to be fire and water proof and free from any tendency to rot, mold, or decay. It is vermin proof and odorless. Material can be sawed with an ordinary handsaw just like wood and can be easily fitted around T-irons for ceiling insulation merely by rubbing it against the T-iron until a perfect fit is obtained. It is said to possess good structural strength such that walls for instance made of Foamglas, will readily support the insulated ceiling. Vapor resistance approaches 100%, due to the cells being air tight and not connected with one another, this making the insulation especially suitable for cold storage rooms in meat packing, dairy, and ice cream plants, in breweries, and in similar insulating applications where considerable moisture is present.
SIZES—Available in one board size, 12 x 18 in. in standard thicknesses in 2, 3, 4½ and 6 in.
MADE BY—*Pittsburgh-Corning Corporation. Distributed by Armstrong Cork Company, Building Materials Div., Lancaster, Pa.*

Dust Protector

NAME — American R9100-T respiratory protector.
PURPOSE — For protection against poisonous and other dusts encountered in industry.
FEATURES—Approved by the U. S. Bureau of Mines, this closely felted laboratory tested filter is said to be proof against the inhalation of toxic or poisonous dusts and particulate matter (formed by disintegration of solid materials during such processes as crushing, grinding, and abrasing) as lead, cadmium, arsenic, chromium, manganese, selenium, vanadium, and their compounds. Face piece easily adjustable, with pliable leak-sealing edge. Exhalation valve non-reversing and gives positive protection.
MADE BY—*American Optical Company. Southbridge, Mass.*



Pressure Gauge Gears

NAME — Patent Cam and Roller Movement.
PURPOSE — For use in indicating pressure gauges.
FEATURES — This gauge movement employs a sector-shaped driving cam and a driven helical roller. One end of the pivoted cam is linked to the Bourdon tube while the other end is aligned with and fits freely into the thread of the roller. Smooth and constant transmission of motion is said to be obtained by reason of the elimination of lost motion, this resulting from having the edge of the cam in constant contact with the wall of the helical thread. Large gauges are all equipped with an adjustment screw by which it is claimed recalibration of the instrument is very simple. Adjustment of the screw from the outside gives the desired calibration, the range of adjustment being equal to one-half of the total dial, or about 90 degrees.
MADE BY—*Certified Gauge and Instrument Corp., 34-18 Northern Blvd., Long Island City, N. Y.*

Caulking Compound

NAME—Johns-Manville Duxseal.
PURPOSE—For use as an all-purpose sealing and caulking compound.
FEATURES—Used like putty, this compound is said to stick readily to any clean surface without slumping, flowing or hardening in service and is also said to be insoluble in water, unaffected by ordinary gases and condensates, and non-injurious to the hands. Compound said to be especially suitable for caulking around window frames, ventilator shafts, duct openings, and the like. Originally developed for utility companies for sealing openings in ducts carrying electrical conductors, it is recommended for maintenance engineers, mechanics, plumbers, and home owners.
SIZES AND CAPACITIES — Available in 1 lb and 5 lb pugs, in cartons of 60 and 12 pugs, respectively.
MADE BY—*Johns-Manville, 22 East 40th St., New York, N. Y.*

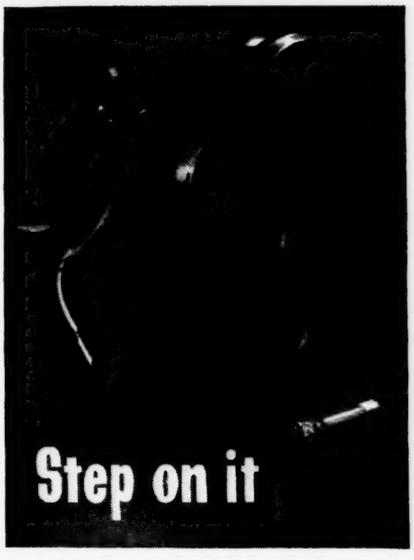
FIGHTING FIRES before they start

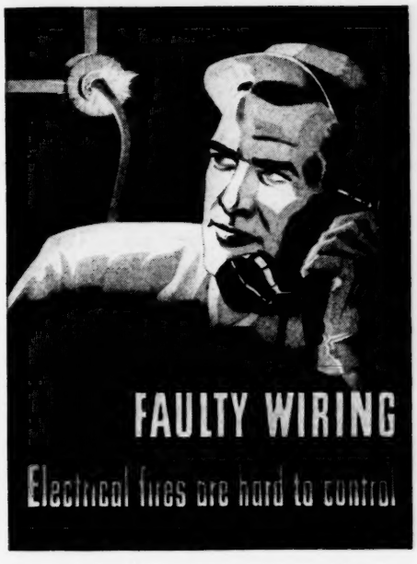
Most fires are preventable. A smoldering cigarette, flipped carelessly into a dark corner . . . a welder's spark flying unnoticed into a pile of oily waste—these little things can, and do, start devastating fires.

At the beginning of the war emergency, recognizing that fire is a treacherous and deadly saboteur of production, Bethlehem intensified its attack on the fire hazard. As always, trained, fully-equipped fire-fighting forces supplied the backbone of the fire-control effort, maintaining day-and-night vigilance in every Bethlehem plant and shipyard.

But to bring home the vital importance of fire prevention and control to every Bethlehem employee, we've designed a series of posters in full color and are displaying them in key locations throughout all Bethlehem shipyards and steel plants, which are now engaged in vital war work.

These posters are based on analysis of the most serious causes of fire and the all-important part of the human element in fire prevention. By pointing out to employees specific ways in which they can prevent or subdue fires, the posters are helping to minimize a potentially grave threat to the production of war materials.

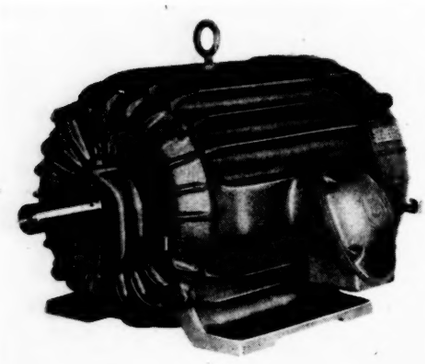




Five of Bethlehem's series of fire-prevention posters. These posters are printed in full color. Each poster is designed to emphasize a specific problem in fire prevention or control.

BETHLEHEM STEEL

War-production plant executives who are carrying on fire-prevention campaigns may find these posters of interest. A complimentary set will be supplied on request to Bethlehem Steel Company, Bethlehem, Pa.

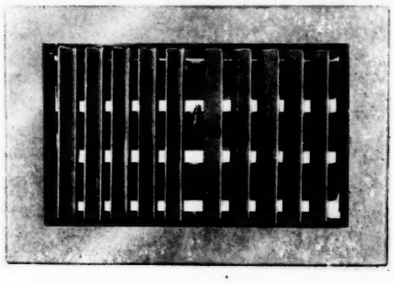


Crocker-Wheeler Enclosed Motor

NAME—Crocker-Wheeler Cowl-cooled motor.
PURPOSE—For applications requiring totally enclosed motors.
FEATURES—Ventilating air is blown over the external ribs which run the length of the frame instead of being forced through the conventional internal passages. Standard NEMA frame mounting dimensions. Frame of heavy cast iron with feet cast integrally. Windings are without a single soldered joint. Wire is enameled and coils are treated with the vacuum impregnation process. Rotor bars, fans, and end rings are die cast from aluminum alloys and from one piece with no joints. Cast iron fan wheel keyed to the shaft. Cowl, including grid, is of one piece cast iron with cowl readily removable. Bearings, either sleeve or ball type. Interchangeable front and rear end shields.
SIZES AND CAPACITIES — Three-quarter hp to 25 hp. 220, 440, 550 volt, 3-phase furnished for 60 cycle current. One-half to 10 hp with above voltages for 25 cycle current.
MADE BY—*Crocker-Wheeler Electric Manufacturing Co., Ampere, N. J.*

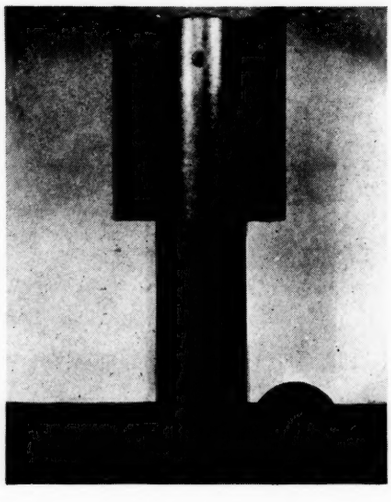
Air Registers and Grilles

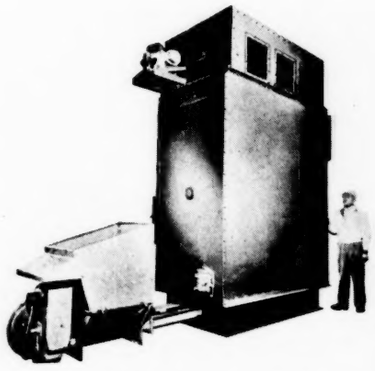
NAME — Registers, type STR and grilles, type GR.
PURPOSE — For general air conditioning and ventilation, including marine work.
FEATURES—Grilles consist of three parts: frame, face plate, and a series of front and back blades which are adjustable. Frame is made of 20-gauge steel with edges bent over twice to insure rigidity. Blades are of 24-gauge cold rolled steel, streamlined. Vertical blades are individually movable and spaced so as to leave ⅜ in. openings. They are adjustable and have set screws for locking into position when once set. Rear blades are linked together at both ends and are made to fit tightly so as to eliminate whistling noises when completely closed. Grilles, too, are made of cold rolled steel with horizontal blades held in position in the frame by metal teeth solidly welded at the end. All registers or grilles Parkerized or cadmium plated after manufacture.
SIZES — Registers available in all sizes from 6 x 6 in. to 30 x 10 in. Grilles from 6 x 8 in. to 30 x 12 in.
MADE BY—*Davies Air Filter Corp., 118 East 25th St., New York, N. Y.*



Hot Water Tank Insulation

NAME — H & D air-cell insulating jacket.
PURPOSE—For insulating hot water storage tanks.
FEATURES—Consists of strips of 5-ply air-cell insulation on a wrapping sheet. The outside of the sheet is finished in wood-grain, gray, or green, and when the sheets are wrapped around the tank the longitudinal seams are sealed with a cloth tape matching the finish on the insulating sheet. Advantages claimed for this insulation include: (1) good appearance, (2) cooler heater room in summer, and (3) fuel saving. The covering is also suggested as a means of camouflaging hot water tank installations in remodeling.
SIZES AND CAPACITIES — To fit standard 30 gal or 40 gal tanks.
MADE BY—*The Hinde & Dauch Paper Co., Sandusky, Ohio.*





Coal Fired Unit Heater

NAME—Dravo direct fired coal burning heater.
PURPOSE—For space heating.
FEATURES — This is offered as an entirely self-contained heating unit with its own combustion chamber. It distributes warm air directly from outlet vents into the area to be used, or through a simple duct system if desired. The heater is equipped with an underfeed stoker of either bituminous or anthracite type, and with either hopper or bin feed; or it can be hand-fired and used with undergrate fan. Corrugated combustion chamber has fins and deflectors which promote good heat transfer. Ample combustion space insures complete burning of fuel without smoke before the gases strike cold surfaces. Tightly welded combustion chamber prevents infiltration of excess air. Unit may be installed during construction of a building and used for temporary heat, then retained as a permanent fixture. Manufacturer claims a saving of 40 to 50% in the amount of steel required as compared with boiler plants of equal rating.
SIZES AVAILABLE — 8 sizes from 750,000 to 4 million Btu output per hr.
MADE BY — *Dravo Corp., 302 Penn Ave., Pittsburgh, Pa.*

Asbestos-Faced Board

NAME—Carey "A-D" board.
PURPOSE — For fabrication of return ducts, for interior lining of elevator shafts, and other uses.
FEATURES — This is a laminated board faced on both sides with asbestos and said to be flame proof, moisture resistant, odorless, clean, light in weight, and to have sound-deadening qualities. Easily cut or sawed to fit and quickly applied with nails or staples.
SIZES AVAILABLE—Standard packages of 8 sheets, 33 x 60 in. x ⅛ in. thick (110 sq ft per package).
MADE BY—*The Philip Carey Mfg. Company, Dept. 49, Lockland, Cincinnati, Ohio.*

How much air can you clean with a penny?

YOU CAN INSTALL Dust-Stop* Air Filters for 1¢ per CFM. You can replace them for 1/10 of 1¢ per CFM. They can be installed or changed easily and with a minimum of time and expense. Furthermore, Dust-Stops can be cleaned several times by gently rapping or vacuum cleaning.

In other words, a penny cleans a whale of a lot of air *with Dust-Stops*.

Dust-Stops are now at work in war production plants throughout the country. They are helping to maintain cleaner, more healthful working conditions and more accurate precision manufacture with fewer rejects.

THESE ARE DUST-STOP FEATURES:

Efficiency?—PLENTY! Dust-Stops remove virtually all the nuisance dust, dirt, and pollen from the air. Dust-Stop efficiency is ample for the needs of most manufacturers.

Fire-Safety?—Dust-Stop filtering material is glass . . . the individual fibers CAN'T burn. The adhesive is non-combustible.

Performance?—Dust-Stop capacity is 2 CFM per sq. inch of area at 300 FPM. Average resistance, new, in inches of water gauge: .062 for 1-inch, .13 for 2-inch.

Available?—Right now! Deliveries are immediate on all standard sizes of Dust-Stop filters. Dust-Stops are made 100% from American materials.

Who Carries Dust-Stops?—Your air-conditioning manufacturer, jobber, or dealer. Or write us. You can get No. 1 (1-inch thick), No. 2 (2-inches thick). Pick up your phone, now, and order Dust-Stops.

FIBERGLAS*

DUSTOP*

* T.M.Reg. U.S. Pat. Off.

AIR FILTERS

Made by Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, write to Fiberglas Canada, Ltd., Oshawa, Ontario.

Non-Metallic Ductwork

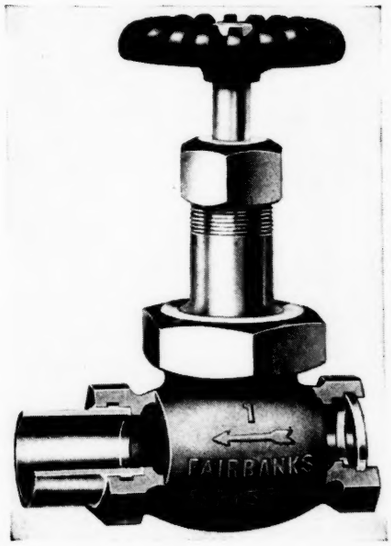
NAME—Formdux.
PURPOSE—Designed especially as an alternate for sheet metal, and to save the critical metals used therein, in warm air ductwork installations in the Government's 1942 housing program.
FEATURES—Formdux is made in sheets resembling standard metal sheets used in warm air furnace work and is said to have a high tensile strength, to be completely fireproof, and capable of being used in forming plenum chambers. When used in the average home the steel requirement is said to be about 81 lb as against 458 lb of sheet steel normally required. The heat insulating value is said to be high and resistance to air flow very low. Sheets are economical to install and can be put together with air-tight connections by sheet metal workers. The complete lack of expansion and contraction prevents noises usually associated with sheet metal in heating work. Formdux is approved for homes financed by F.H.A.
MADE BY—*Airtemp Division, Chrysler Corporation, Dayton, Ohio.*

Chimney Furnace

NAME—Fluemaster furnace.
PURPOSE—For warm air heating of low cost Victory Houses and other small homes.
FEATURES—This heating unit consists of a fire pot and heat exchanger, both entirely concealed inside the brick chimney of the home. Fire pot is located on either the first floor or the basement. The heat exchanger is of heavy metal construction, porcelain-enameled, and extends from the top of the combustion chamber up through the flue to a point several feet above the attic floor, where an automatically controlled blower is located. Hot combustion gases travel up through the exchanger and thence on up through the chimney proper to the outside. The blower forces air down through the space between the inner walls of the chimney and the heat exchanger in a counter-flow action, and the heated air issues through baseboard, wall or ceiling grilles and circulates in the various rooms. Return air is drawn through wall baseboard grilles, up through studding spaces, across through attic floor joists back into the blower, and from there recirculated. Advantages claimed for this system are savings in space, fuel and critical materials. Designed for coal burning, but is claimed to be easily converted to oil or gas.
MADE BY—*Round Oak Company, Dowagiac, Michigan.*

Valve with Brazed Connections

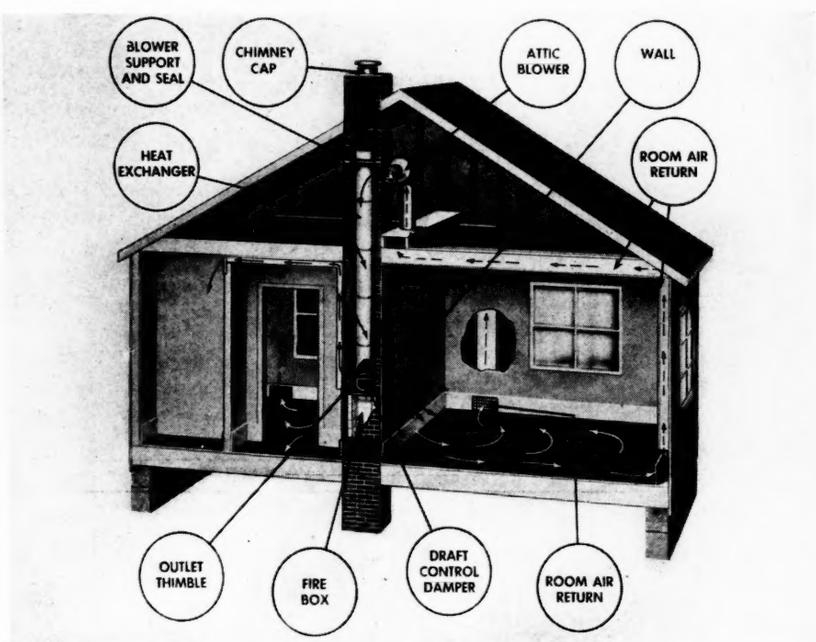
NAME—Faircoseal bronze valves.
PURPOSE—To provide leak-proof valve joints without the necessity of using wicking or soldering.
FEATURES—These valves contain pre-inserted lengths of Sil-Fos silver brazing alloy instead of threads in the port openings. Installation is made by inserting pipe ends into ports and applying an oxy-acetylene flame, which causes fusion of the alloy rings and thus bonds pipe and valve together. Copper, yellow or red



brass, copper-nickel, and monel pipe can be used. Steam, oil, hot or cold water, compressed air, acid, freon, sulphur dioxide, and other liquids and gases can be handled successfully, according to the manufacturer. Joints are said to be of high tensile strength and will not pull apart at any temperature to which the valve can be safely subjected. Composition of the brass alloy is such that corrosion resistance of completed joint is same as parts joined.
MADE BY—*The Fairbanks Company, 393 Lafayette Street, New York, N. Y.*

Corrosion Preventive

NAME—Micromet.
PURPOSE—To prevent scale and to control corrosion in air conditioning units, mechanical washing equipment, and household water systems.
FEATURES—Micromet is a glassy sodium phosphate of a special slowly-soluble type. Introduced into water solutions it has the same anti-corrosion action as the more soluble forms of glassy phosphates commonly used in municipal water and industrial cooling systems for this same purpose. When placed in cold water it dissolves at the rate of 25% per month. The concentration necessary to prevent corrosive action in the systems mentioned is only 5 parts per million or 1 lb to each 24,000 gal of water. When used in air conditioning units the substance usually is fed by means of a shallow screen basket placed in the sump of the unit or by a simple pot-type feeder of standard galvanized or black iron pipe placed in the feed water line.
SIZES AVAILABLE—Comes in units of 1, 1½ and 5 lb.
LITERATURE—12-page booklet.
MADE BY—*Calgon, Inc., 323 Fourth Ave., Pittsburgh, Pa.*



...to get MORE Refrigeration with your present compressor •plus power savings•install the NIAGARA *Duo-Pass* AERO CONDENSER

In hot weather, reducing the head pressure from 195 lbs. to 165 lbs. adds 10% to 15% extra capacity to your refrigeration system.

Users of the Niagara Aero Condenser, with the new patented Duo-Pass, have gained such advantages—and have saved from 15% to 35% of power, and 95% of water, consumed by present equipment.

These savings are permanent, because the Duo-Pass pre-cooling prevents clogging of condenser tubes with scale; inexpensively gained because the Aero Condenser replaces both cooling tower and shell-and-tube condenser.

Write for Bulletin #91 & #93

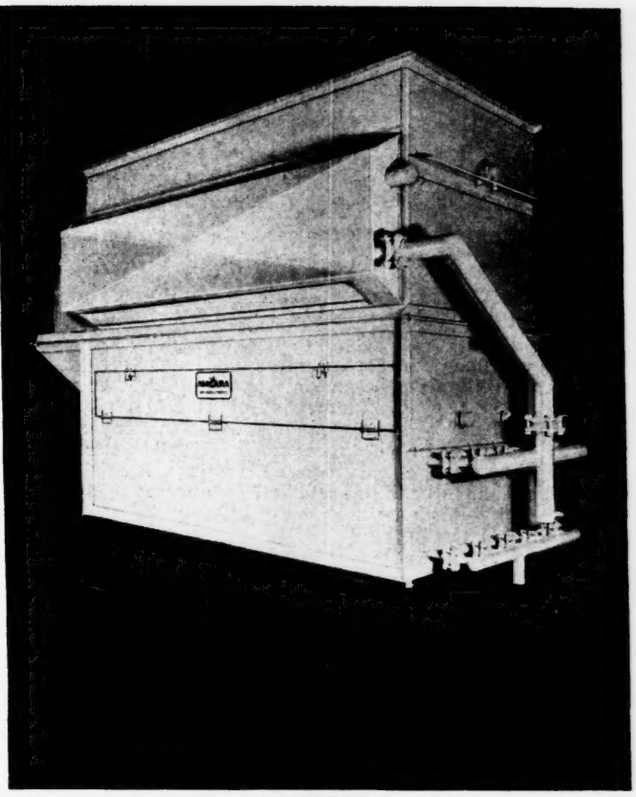
NIAGARA BLOWER COMPANY

Dept. HV-72

6 E. 45th Street New York City

Chicago: 37 W. Van Buren Street
Seattle: Fourth & Cherry Bldg.
Buffalo: 673 Ontario Street

Sales Representatives in Principal Cities



PATENTED

NIAGARA INDUSTRIAL COOLING • HEATING • DRYING HUMIDIFYING • AIR ENGINEERING EQUIPMENT

SOMERS HAIR GLASS FILTER "V" type

INDUSTRIAL AIR CONDITIONING Needs SOMERS HAIR GLASS FILTERS

Somers Filters are built with frames of galvanized metal, packed with Hair Spun Glass — washable — odorless — non-absorptive—non-rotting—and are practically indestructible.

Dust, dirt, pollen, detritus and industrial wastes in the air stream effectively removed with minimum back pressure. No adhesives required.

Made in every size required for industry. In use in a wide range of factory applications, for chemical, textile, and metal-working installations where precision is a factor.

Quotations supplied on receipt of c.f.m. per unit and dimensions of master holding frames. A few choice territories open for qualified representatives.

H. J. SOMERS, INC., 6067 WABASH AVE. DETROIT, MICH.

You have often helped US... Now, perhaps we can help YOU!

WE owe a lot to the loyalty of architects, engineers, contractors and service men who have been emissaries of good-will for Johnson Oil Burners.

Now...when the problem of getting needed equipment is so great ...maybe we can return the favor. There are many Johnson Burners still available on A-10 or better Priorities. Not all sizes or types, of course ...but more than perhaps you know.

A WIRE or letter describing what you need will get a quick "yes" or "no" from us, plus any constructive suggestions we can offer. Believe us, we'll try...*really* try...to help you. Give us the chance if you have a heating "headache".

STILL AVAILABLE... the famous Johnson AVH!

We can supply this fine Rotary Burner in sizes ideally suited to military and war-time industry installations.

FREE COMPLETE SPECIFICATIONS

S. T. JOHNSON CO.

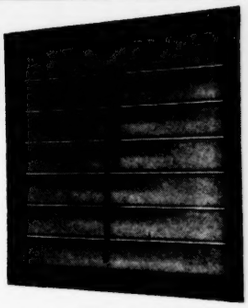
940 Arlington Avenue • Oakland Calif.
401 N. Broad Street • Philadelphia Pa.

Elgo Ventilating Specialties

Counter-Balanced Automatic Shutter

A shutter with a patented counter-balancing mechanism that makes the louvres open the instant the fan or blower starts, and snap tight-shut when the air current stops. Never any flapping or fluttering. Adjustable for different air velocities. Completely weather-stripped.

Write for catalog and prices!



"ELGO" TYPE AUTOMATIC SHUTTER Rear View (Closed)

Free CATALOG

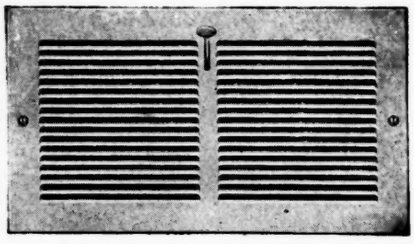
ELGO SHUTTER & MANUFACTURING CO.
6968 W. Jefferson Detroit, Mich.

REGISTERS for SMALL HOMES and GROUP HOUSING

With the widespread use of simplified heating systems, often stripped to the bare essentials, small homes and housing projects need the added efficiency of Auer Registers. There are many Auer warm-air models suited to low-cost house requirements, such as the Airo-Flex "7000" Series shown here. This is a single louvre register with downward directional fins, bendable for other angles if desired. If you are equipping small home jobs, it will pay you to know about the Auer line.

Write for Auer Register Book showing all models for warm air and air conditioning. Separate Catalog "G" also available on flat metal grilles.

The Auer Register Co.
Cleveland, Ohio



Airo-Flex 7032 Single Louvre Adjustable Register

AUER REGISTERS
& GRILLES · For Air Conditioning *and* Gravity

AIR CONDITIONING NOZZLES

Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

Many large users—installations total more than 5 million gallons per minute in water cooling and air conditioning service. Write for Bulletin N-615.

YARNALL-WARING COMPANY
104 MERMAID AVENUE
PHILADELPHIA

YARWAY

UNIT HEATERS

Dravo Corporation, 302 Penn Avenue, Pittsburgh, Pa.

A multigraphed, 3-page binder assembly describing the development and operation of the company's coal burning stoker fired unit heater.

ELECTRICAL EQUIPMENT

Westinghouse Electric & Manufacturing Co., Dept. 7-N-20 East Pittsburgh, Pa.

"Quick Selector" catalog 30-000, a 64-page standard size publication giving electrical ratings, physical dimensions and circuit diagrams covering such equipment as safety switches, no-fuse breakers, multi-breakers, panelboards, motor control and motors. New application data also included.

BOILER CONVERSION

National Radiator Company
221 Central Ave., Johnstown, Pa.

To facilitate conversion of oil-fired boilers to coal, a 23-page reference catalog entitled "Conversion Packages" is offered for use by salesmen, branch offices, warehouses and manufacturing divisions. Detailed are all parts and prices necessary for the changeover of the company's existing coal-fired boilers during the emergency.

RECORDING THERMOMETERS

The Bristol Company, Waterbury, Conn.

A six-page bulletin T302, 8 x 10½ in., describes and illustrates the company's line of fully compensated liquid-filled recording thermometers for temperatures between —125F and 400F. Construction and application information included.

RUBBER CONSERVATION

United States Rubber Company, Rockefeller Center, New York, N. Y.

This two-color, forty-eight page illustrated booklet on conservation of industrial rubber products gives complete and explicit suggestions for the care of important rubber articles. The book is completely indexed and covers all mechanical rubber goods. Methods of guarding against the action of oils, grease solvents, concentrated acids, extreme heat, dryness, sunlight, and ozone, are outlined in detail.

EQUIPMENT RELEASE

Bell & Gossett Company, Morton Grove, Illinois

A broadside mailing piece announces release of certain hitherto frozen materials under the authorization of an amendment to Limitation Order L 79. Typical examples of the company's products affected by this release are shown.

ELECTRICAL CHECK CHART

Westinghouse Electric & Mfg. Company
Dept. 7-N, East Pittsburgh, Pa.

A pasteboard maintenance check chart, 16½ x 21½ in. is available for posting on plant bulletin boards. It will be useful as a maintenance reminder in upkeep of motors, controls, arresters, wiring fuses, and transformers.

DYNAMIC BALANCER

Bear Manufacturing Company, Rock Island, Ill.

Standard size, 16-page catalog illustrating the company's six models of balancing machines used for balancing armatures, blower wheels, propellers, and the like.

COMBUSTION

The Hotstream Heater Co., 8007 Grand Avenue, Cleveland, Ohio.

Standard size, four-page bulletin giving detailed information regarding fuel oil combustion. General information, formulas, operating data, efficiencies, and a discussion of auxiliary equipment are included. A very useful pamphlet.

CONTROLS

Wheelco Instruments Company
Harrison & Peoria Sts., Chicago, Ill.

Standard size, 16-page bulletin Z-6000 describes and illustrates the company's control and measurement instruments. Two pages are devoted to the Flameotrol, electronic combustion safeguard. The all-purpose controller is also covered in its various applications.

PREFABRICATED CONDUIT

The Ric-wiL Company, Union Commerce Bldg. Cleveland, Ohio

A twelve-page, two-color, engineering bulletin covering underground and overhead prefabricated piping units and tile conduit systems. Suggested specifications and engineering details are included, as well as tables of conduit capacities and the required trench dimensions for each unit.

AIR DIFFUSERS

Dorex Div., W. B. Connor Engineering Corporation
114 East 32nd Street, New York, N. Y.

Bulletin WF-13 describes and illustrates the Kno-Draft type W-A-R, model F high velocity ceiling type air diffuser. Bulletin D-15 is a supplementary bulletin showing the application of type Dee volume dampers to the Kno-Draft diffusers. Each is four-page standard size bulletin.

ELECTRICAL MAINTENANCE

Westinghouse Electric & Mfg. Company
Dept. 7-N-20, East Pittsburgh, Pa.

A two-volume set of maintenance rules and suggestions is now available to maintenance men concerned with the care of electrical apparatus in industry. Consists of 220 pages in loose-leaf style, 5 x 7 in. binders.

AIR RECOVERY

Dorex Div., W. B. Connor Engineering Corp.
114 East 32nd Street, New York, N. Y.

A standard size, 4-page folder which tells the story of air recovery. Contains some interesting data regarding heat and refrigeration savings made possible by its use.

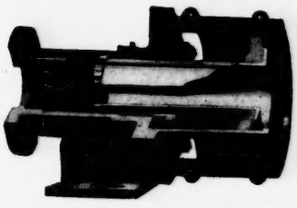
VENTILATION

Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill.

Standard size, four-page bulletin, showing the application of the company's power roof ventilators and fresh air louvers, with blackout hoods attached.

Photo Courtesy of Curtiss-Wright Corp.

BY SAFE-GUARDING STEAM LINES AT ARMY AND NAVY AIR BASES



From Pearl Harbor to Newfoundland; from Alaska to Pensacola; from San Antonio to Wright Field, the ADSCO Internally-Externally Guided Expansion Joint safeguards hundreds of miles of steam, hot water, fuel oil and gasoline lines by controlling expansion and contraction of pipe lines to hospital buildings, hangars, shops, and warehouses.

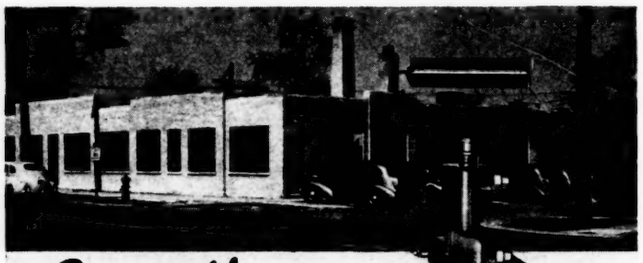
This completely guided joint meets Army and Navy specifications, and also has been approved for many years by leading mechanical engineers for installation in industrial plants, colleges, institutions, and railroad terminals.

The ADSCO Internally-Externally Guided Expansion Joint and other ADSCO products such as tile conduit, wood casing, meters, water heaters, steam traps, etc., reflect over 60 years experience in the manufacture of steam distribution equipment. For detailed information on ADSCO Products, write for Catalog No. 35V.

AMERICAN DISTRICT STEAM COMPANY NORTH TONAWANDA, N. Y.

Making "UP-TO-DATE" Steam Line Equipment for over 60 Years.

ADSCO INTERNALLY EXTERNALLY GUIDED JOINT



Sarcotherm
HOT WATER CONTROL
BY THE WEATHER

This simple, mechanical system provides continuous circulation of hot water at temperatures varied automatically in accordance with changes in outside temperature.

The gradual modulation of radiator temperatures is accomplished by blending a varying portion of the boiler water with the return. Sarcoflow balancing fittings in individual radiator connections balance the system.

In factories and apartments it provides de luxe modulated heat with reduced fuel costs. Ideal for modernization of institutions and homes.

Ask for Catalog No. 175.

128

SARCO
SAVES STEAM

SARCO COMPANY, INC.
475 Fifth Avenue, New York, N. Y.
SARCO CANADA LTD., FEDERAL BLDG., TORONTO, ONT.

HEATING and VENTILATING'S
REFERENCE SECTIONS

Helpful information in concise form for the heating engineer and contractor. Price, 25c each.

RADIANT HEATING

Practical information on design and construction of radiant heating systems, with examples of modern installations.

UNDERGROUND STEAM PIPING

How to design an underground steam system, with data for solution of problems and descriptions of typical installations.

VENTILATION AND HEATING OF AIR RAID SHELTERS

Types of air raid shelter equipment necessary for adequate ventilation, with data for the design engineer.

SAVING FUEL FOR HEATING

Practical summary and guide on fuel conservation, showing step by step the procedure to follow to get the most out of a heating plant.

Send your order with remittance to

HEATING and VENTILATING
148 Lafayette St., New York City

PERSONALS AND PERSONNEL

J. E. CORBETT

Penn Electric Switch Co., Goshen, Ind., has appointed J. E. Corbett as manager of the company's Moline, Ill., branch. For the past five years, Mr. Corbett has been a sales engineer for Penn in the New York territory. Howard C. Shilling, who was in temporary charge of the Moline office on a part-time basis, will again devote his entire attention to the Chicago territory in conjunction with E. B. Maire, Chicago branch manager.

J. M. DALLA VALLE

has become associated with the Kruse Engineering Company, 24 Commerce St., Newark, N. J., designers of dust control systems and other systems for the control of occupational diseases. For a year prior to joining Kruse Mr. Dalla Valle was engineer with the Division of Industrial Hygiene, New York State Department of Labor, and prior to that, from 1931 to 1941, was an engineer engaged in industrial hygiene work with the United States Public Health Service in Washington. From 1929 to 1931 Mr. Dalla Valle was engaged in consulting engineering work in Cleveland.

CLOUD WAMPLER

executive vice-president of Carrier Corporation, on June 25 was elected president, succeeding the late J. Irvine Lyle. At the same meeting, Edward T. Murphy, senior vice-president of the Corporation, and one of its founders, was elected a member of the board of directors to succeed Mr. Lyle. Prior to becoming executive vice-president of Carrier, Mr. Wampler was president of Stern, Wampler & Co., Inc., Chicago. He began his business career with the Harris Trust & Savings Bank of that city in 1916, and a year later entered the U. S. Army in which he served as a general staff officer, both in this country and abroad. After the war he returned to the Harris Bank and later entered the private banking business in Chicago.

HAROLD F. MARSHALL

sales and advertising executive for Warren Webster & Company, has been ordered to active duty with the U. S. Army Air Forces, with the rank of Captain. He was ordered to active duty May 14 at the School for Special Service, Fort George B. Meade, Maryland, for a 30-day course of instruction. He was graduated on Monday, June 15, and has been assigned to duty with the Army Air Force Materiel Command at Wright Field, Dayton. Captain Marshall, who has headed the Webster advertising department since 1924 and been assistant sales manager since 1927, served as a first lieutenant and pilot in World War I with the 88th Observation Squadron. Ben F. Lerch, for many years associated with him in the Webster advertising and sales department, will carry on Captain Marshall's work for the duration.

H. F. Marshall

WITH THE MANUFACTURERS

E. I. DU PONT DE NEMOURS & CO.

announces that the R. & H. Chemicals Department has been renamed the Electrochemicals Department. The department's original name came from the Roessler & Hasslacher Chemical Co., which du Pont acquired in 1930.

PEERLESS OF AMERICA, INC.

announces that its manufacturing facilities are now located at Marion, Indiana, and its Chicago office at 333 N. Michigan Ave.

SPENCER HEATER DIV.

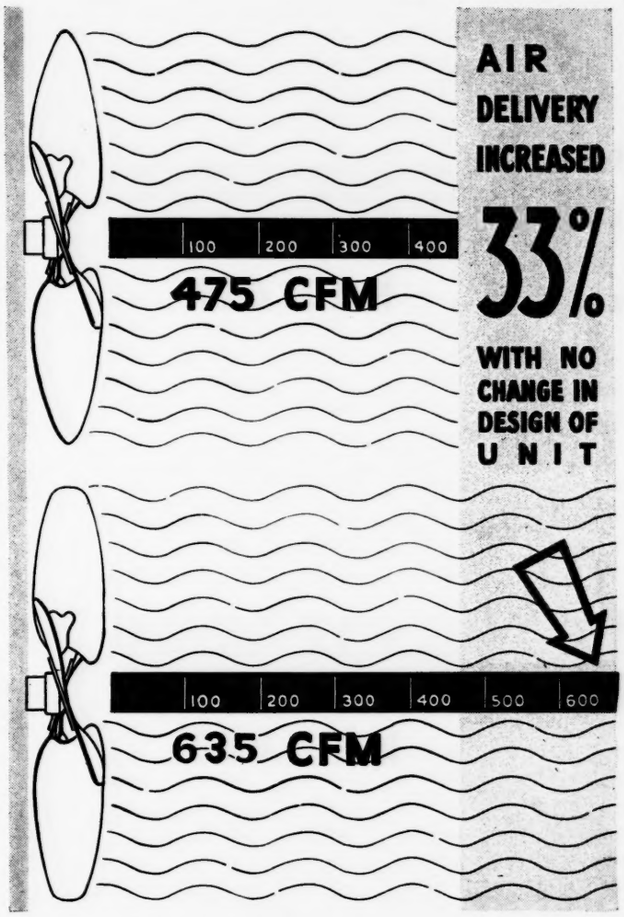
of The Aviation Corp., Williamsport, Pa., has launched a campaign to protect and conserve home heating systems for the duration of the war and to help heating contractors build up their repair and service business. Emphasizing that every home owner is a prospect, Spencer Heater has enlisted heating contractors throughout the country in a Spencer Reserve Corps. The organization has the following three-point program: To conserve and protect every piece of existing heating equipment; to provide an inspection and repair service that will assure the most efficient operation possible of every plant; and to handle, where necessary, replacements of boilers or parts, or conversion jobs from oil to coal.

WOLVERINE TUBE CO.

Calumet and Hecla Consolidated Copper Company on June 3 announced the purchase of the entire assets and liabilities of the Wolverine Tube Company of Detroit. This followed a proposal made by Calumet and Hecla to the stockholders of Wolverine Tube which was approved by them on April 28, 1942. Operations will continue at the plant and offices as the Wolverine Tube Division of Calumet and Hecla Consolidated Copper Company with production for the war effort uninterrupted. Otto Z. Klopsch will serve as general manager of the Wolverine Tube Division.

E. B. BADGER & SONS CO.

on June 15, before a large gathering of employees and their families, was awarded the Navy E for production achievement by Captain W. D. Puleston, U.S.N., representing the Secretary of the Navy. Governor Leverett Saltonstall was the principal speaker at the ceremony, and commented on the contribution of Massachusetts labor and management to the war effort. Cambridge, site of the Badger plant, and Boston, home of the Badger offices for more than 100 years, were represented by Mayors John H. Corcoran and Maurice J. Tobin.



A UNIT heater manufacturer found it necessary to increase the air flow through one of the models from 475 CFM to 635 CFM, without changing the design of the unit.

Torrington engineers, on finding that steam coils and direction vanes were causing back pressures which cut down air delivery, recommended a pressure-type fan in place of the free-air model originally selected. They also suggested the use of a slightly larger blade, since they found that the original fan orifice would accommodate the larger size.

These recommendations, together with a change in pitch, resulted in the desired air delivery of 635 CFM —an increase of over 33%.

Consultation with Torrington engineers on fan and blower wheel applications is often helpful in getting maximum air deliveries and highest efficiencies.

THE
TORRINGTON
MANUFACTURING CO., TORRINGTON, CONN.

MANUFACTURERS OF AIRISTOCRAT QUIET PROPELLER FAN BLADES AND AIROTOR BLOWER WHEELS

CARRIER-DOREX-EXECUTONE

A new distributive system bringing two additional products to Carrier dealers and salesmen to help them survive the war period is announced today by Carrier Corp., Syracuse. Under the arrangement developed from the emergency but being tested as a permanent attack on selling costs, Carrier's nationwide distribution organization will be used to merchandise the Executone inter-office communication system, and Dorex air recovery equipment of the W. B. Connor Engineering Corporation. The program, with its broad possibilities for reducing costs of distribution, was developed by J. M. Bickel, manager of Carrier's dealer relations; Hugh T. Porter, general manager of sales of Dorex (W. B. Connor Engineering Corp.); and N. A. Karr, general manager of Executone. Meetings have been held during the last few weeks in Chicago, New York, Atlanta, New Orleans, and Dallas to explain the project to Carrier dealers and salesmen.

YORK ICE MACHINERY CORPORATION

has enlarged and increased the facilities of its Washington offices. To be designated as the National sales office, the establishment will operate as a direct factory branch office located at 215 Investment Building.

H & V's PHOTOS

Page 25—Chicago Architectural Photographing Co.
Page 26—(Top and Bottom) Hedrich-Blessing Studio for Albert Kahn Associated Architects and Engineers, Inc.
Page 33—Hill & Knowlton, Cleveland, Ohio.
Page 60—(Upper left photo) Tube-Turns, Inc.

SUMMER DEGREE HOURS (Above 85F) APRIL AND MAY, 1942†

City	Number of Degree-Hours April, 1942	Number of Degree-Hours May, 1942	Number of Degree-Hours, Summer, 1942, to May 31
Baltimore	11	101	112
Birmingham	44	75	119
Bismarck	5	0	5
Boston	2	10	12
Chicago	33	119	152
Cincinnati	11	50	61
Cleveland	10	14	24
Columbus	19	72	91
Des Moines	0	58	58
Detroit	4	40	44
Ft. Wayne	8	95	103
Houston	—	140	149*
Indianapolis	18	85	103
Memphis	0	128	128
Milwaukee	0	3	3
New Orleans	0	86	86
New York	1	20	21
Oklahoma City	0	123	123
Philadelphia	5	54	59
Pittsburgh	8	43	51
Richmond, Va.	77	111	188
St. Louis	3	79	82
San Diego	0	2	2
San Francisco	0	7	7
Savannah	91	34	125
Toledo	15	66	81
Washington	55	144	199

†No degree hours were reported by Buffalo, Minneapolis or Portland, Ore., in April or May, 1942.
*Total includes 9 degree hours in March, 1942; April had none.

The scene has changed
...but not the requirements

● Valves, traps, vents, gauges and thermometers are being used on a larger scale than ever before—not in the same places, but in the same way. Jobs are fewer; but they are larger . . . and for the first time in any of our lives EVERY job is VITAL.

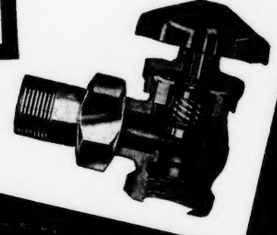
Since it is vital, it calls for the best; and to those who know practical, on-the-job dependability, that means Marsh Equipment. By anticipating the design changes called for by material restrictions, Marsh Products are being made available for practically any essential use.

JAS. P. MARSH CORPORATION
2089 Southport Ave.
Chicago, Ill.

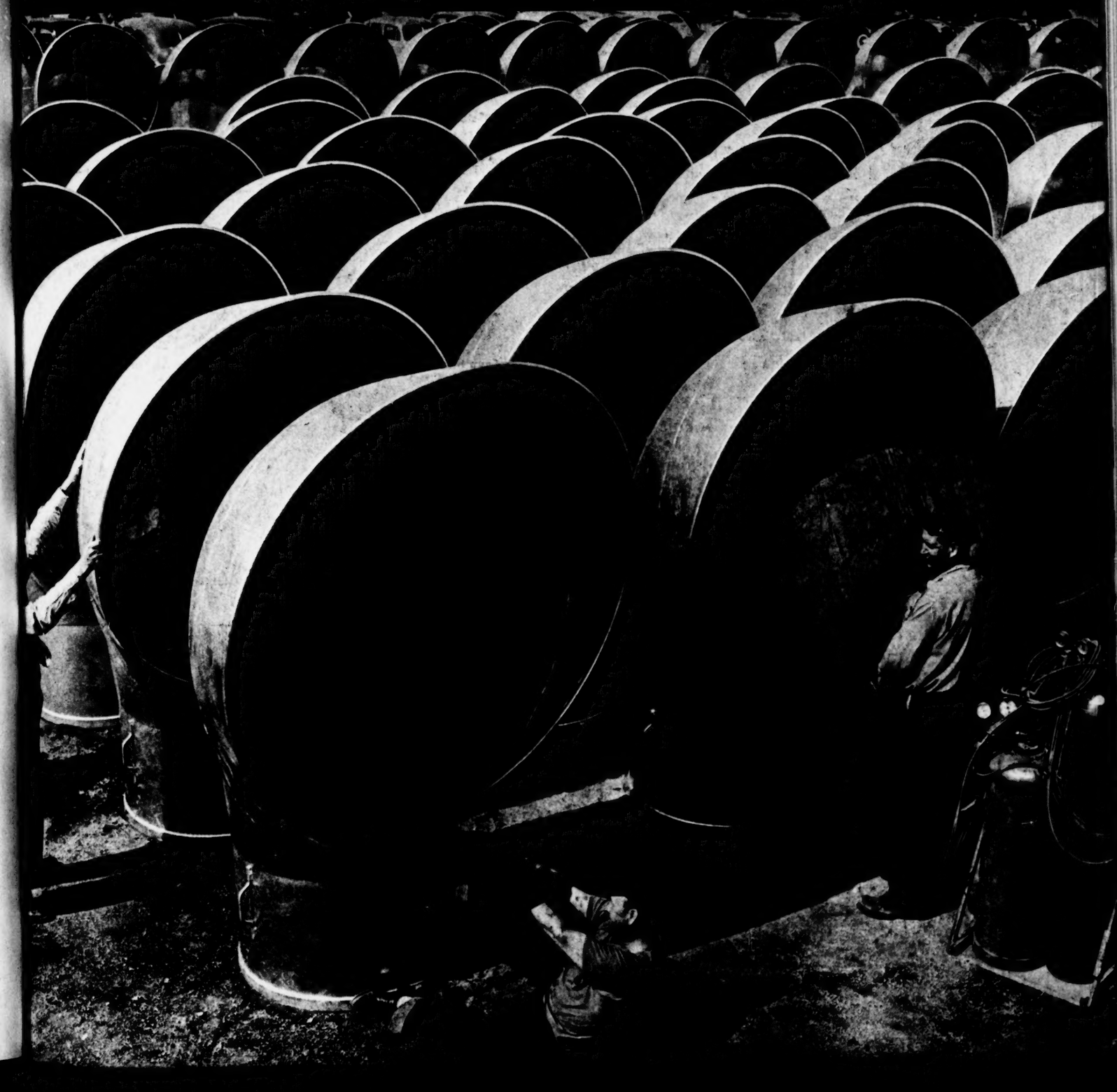
● The No. 12 Drip Trap — ideal for rapid air and condensation removal from short mains, unit heaters, coils, etc. Typical of complete line of floats and thermostatic traps and non-airbinding bucket traps.

● Typical of complete line of radiator traps with highly sensitive thermostatic elements both diaphragm and bellows types.

● A real packless valve with Marsh exclusive metal-to-metal seal. All patterns.



MARSH
QUALITY HEATING SPECIALTIES SINCE 1865
FULL STEAM AHEAD

HEATING AND VENTILATING

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